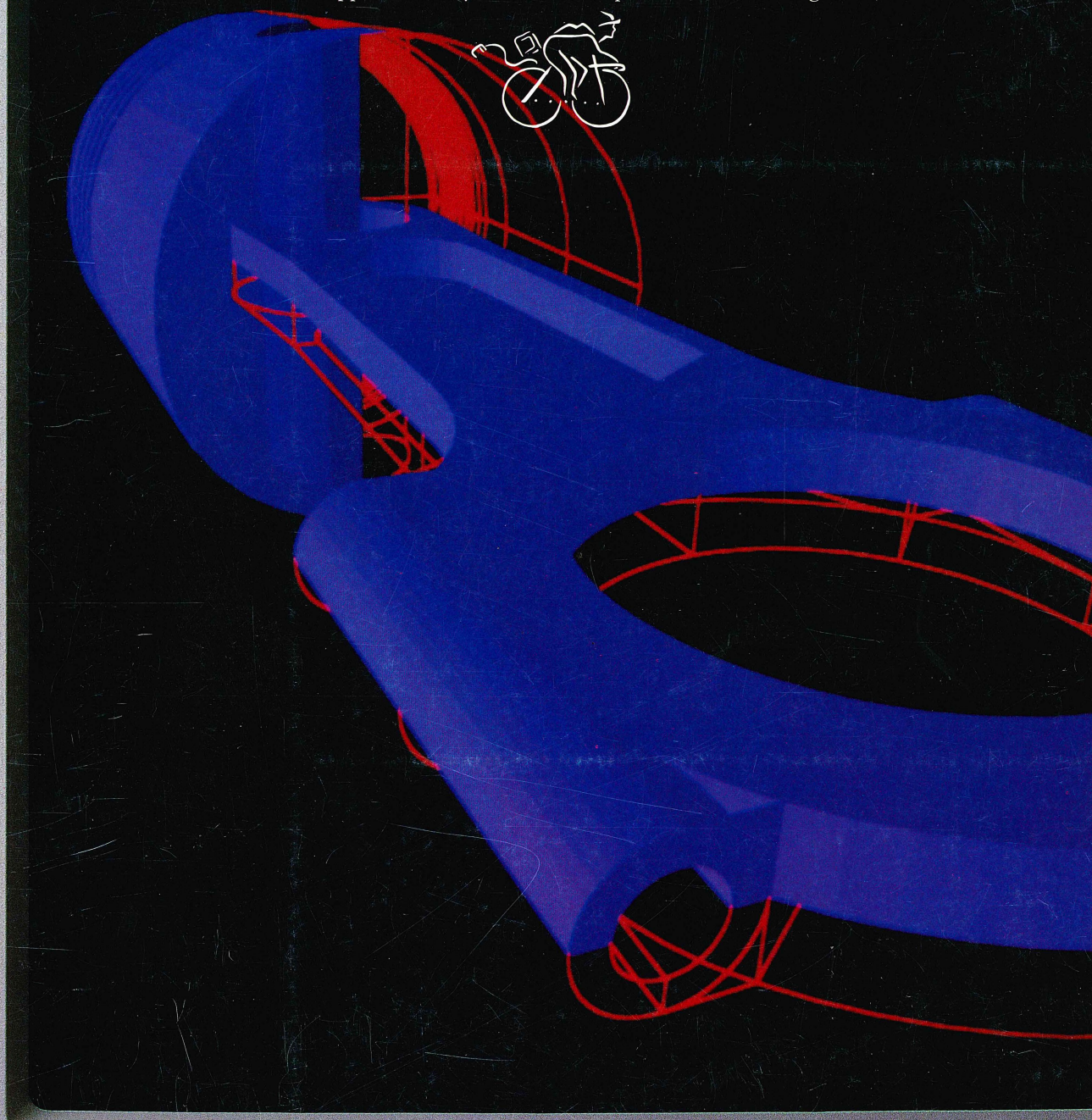
1988
Volume 4 Number 1

WHEELS FOR THE MIND

An Apple University Publication Prepared at Boston College



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We Want to Hear!

We're looking for a good story. Apple is always looking to hear from people who are doing exciting things with our computers. We want to hear from you, talk with you, and be inspired by your work. The information we gather can then be used in *Wheels for the Mind,* posted on AppleLink for other Macintosh users to read, included as success stories in the *AppleGram* mailings, and otherwise used as reference material. Who knows? We may even call you and invite you to show your work at one of our meetings, conferences, or trade shows, or to appear in an Apple brochure.

We are interested in information regarding software development, networking and communications, labs, multimedia, authoring, and productivity solutions, in such disciplines as English, computer science, business, medicine, humanities, foreign languages, and music. We want to hear about anything you think would be of interest to your colleagues at other institutions or to other Macintosh users. You can include any handouts, documentation, illustrations, screen dumps, or other materials that you feel are important to understanding your work. Please provide us with a comprehensive description of your project, including the following information:

- How did your project get started? (history)
- What hardware and software configurations are you using? (include any third-party equipment)
- What resources are required to complete your project?
- How did you achieve funding for your project?
- What are the expected/desired results of your project?
- How has computing enhanced or altered the learning process, your department, the school environment, or other areas?
- How can your experiences benefit other schools or Macintosh users?

Please fill in the information below and attach this sheet to the front of your report. And don't be surprised if an Apple person calls you sometime to hear more about your project.

Name _____

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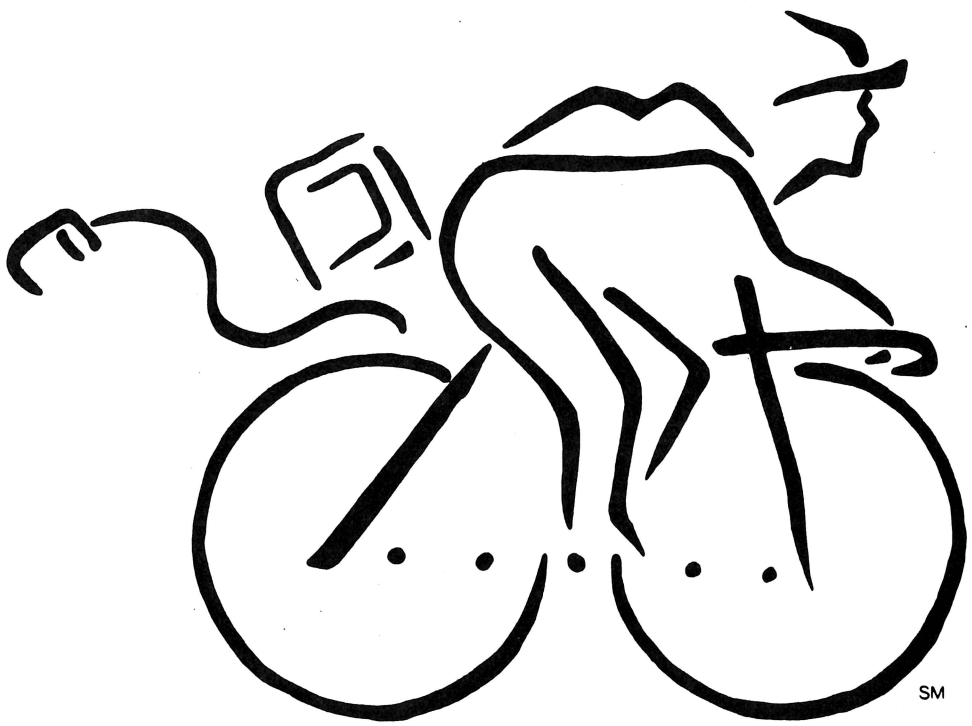
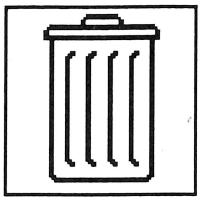


Editorial



It is clear that Apple and the Macintosh computer have made a significant impact upon the academic community. It is not uncommon to find schools with large public computing facilities containing literally hundreds of Macintosh computers. Student dormitories are becoming remote computing sites, and students with computers in their room are no longer considered among the "unusual." Faculty laboratories with Macintosh computers, laser printers, and educational software can be found in many institutions. The personal computer that sits on many a faculty person's desk is, of choice, a Macintosh. Introductory computing courses teach the beginner how to use word processors, spreadsheets, graphics packages, and database-management systems. Classroom display systems that project Macintosh activity upon a large screen are not at all uncommon. Faculty members are using computers to help with their teaching and research. Students are using the Macintosh to support their class work in a wide variety of their courses. Not too long ago, when students finished their "mandatory" computer course, they gleefully abandoned any thoughts of ever actually using a computer again. Now, many seem to take its use for granted.

It is clear that Apple and the Macintosh computer have made a significant impact upon the academic community.

Clearly, great strides have been made in terms of providing a tool for increasing and enhancing one's productivity. Nevertheless, even greater tools are on the horizon. CD-ROM and CD-I technologies have the potential to revolutionize the way in which we all learn. As additional tools for both the teacher and the learner, such technology will contribute much to the excitement we have all experienced in learning.

It will be necessary to move both faculty and students to yet another level with respect to the use of technology in education. Courseware and authoring programs have had marvelous effects at Drexel, Stanford, Dartmouth, and Cornell, to name just a few. I am sure that there are dozens and dozens of success stories among our readership. How are you preparing for using technology in the classroom of the '90s? What plans do you have for integrating technology into your teaching and research? In the next several years, technology will have an even greater effect on all of those involved with education, whether that involvement is as a teacher, a learner, or an administrator.

How are you preparing for using technology in the classroom of the '90s?

Editorial

Perhaps we can use the pages of* Wheels for the Mind *to help us make those great strides.

Perhaps we can plan together. Perhaps we can learn from one another by sharing our experiences. Perhaps we can use the pages of *Wheels for the Mind* to help us make those great strides. In many ways, it is up to you. Share with us your hopes, your dreams, your plans, your strategies.

Let's start it off by asking you to respond to the following question: What plans are under way at your school for bringing your computer users to the "next level"? And what do you think the next level of computer use is?

As always, your letters, articles, work in progress, and project reports are sincerely appreciated.

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Wheels for the Mind

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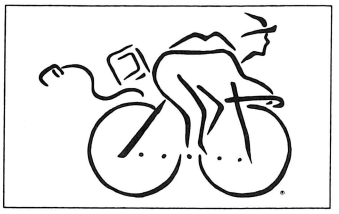
Table of Contents

Volume 4, Number 1



Focus **1**
- The Macintosh in Engineering 1
- University of Iowa: Networking and Robotics 6
- Caltech: Engineering, Research, and Education 8
- Drexel: Using the Macintosh to Provide Expanded Computer Opportunities 9
- Penn State: Macintosh in Teaching and Research 10
- Computer Engineering Resources 18

Spotlight **19**
- Macintosh Activities in the School of Computer Science and Engineering 19
- Case Western Reserve University: Microcomputer Lab 28
- University of New Hampshire: DISCovery Computing Centers 30
- Pennsylvania State University: Medical Database 31
- Drexel University: New Courseware 33
- Australian National University: Publication Tool Development 34
- Reed College: Utility Disks for Students 35

News and Notes **37**
- Introducing Apple's Next-Generation LaserWriter Product Family 37
- How to Contact the Right People at Apple 43
- A Relationship Between Business and Higher Education 45
- MacHack 1988 52
- Computer Law Education Conference 53
- Macintosh Courseware Catalog 54
- Call for Physics Instruction Papers 54
- Software Donations Requested for NASA Aerospace Education Services Project 55
- MacAdemia Update 56

Products **57**
- Engineering Products 57
- Electrical Engineering Applications 58
- Mechanical and Civil Engineering Applications 60
- Chemical Engineering Applications 63
- Industrial Engineering Applications 64
- Engineering Productivity Applications 65
- Nonengineering Products 77

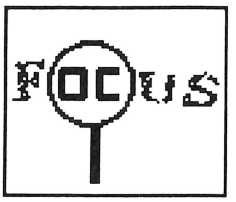
Table of Contents

HyperCard **87**
- HyperCard Applications 88
- Tips and Techniques 90
- Stackware Information 94

Resources **105**
- Business 105
- Computer Science 106
- Databases 107
- Education 107
- Games 107
- Graphics 108
- Hardware 110
- Miscellaneous 111
- Music 112
- Spreadsheets 113
- Telecommunications 113
- Utilities 114
- Word Processing 115

Project Reports **119**
- Authoring Tools 120
- Biology 120
- Business 121
- Chemistry 123
- Computer Science 125
- Economics 126
- Education 127
- Engineering 127
- Fine Arts 129
- History 129
- Liberal Arts 130
- Mathematics and Statistics 131
- Medicine 133
- Miscellaneous 134
- Nutrition 135
- Pharmacy 135
- Philosophy 136
- Physics 137
- Psychology 138
- Social Science 141
- Writing 141

Focus



In this issue, the **Focus** section takes a look at the engineering discipline, examining Schools of Engineering that are using the Apple® Macintosh® personal computer to take a fresh approach to some old problems. And because one of these problems is ensuring that today's engineers-in-the-making get adequate exposure to liberal arts, this section should offer something of interest to everyone.

The Macintosh in Engineering

Overview

In these times of concern about declining literacy, Schools of Engineering have perhaps been one of the hardest-hit areas.

In these times of concern about declining literacy skills—the "Johnny Can't Read" dilemma—Schools of Engineering have perhaps been one of the hardest-hit areas. At a recent meeting of the Accreditation Board for Engineering and Technology (ABET), an industry spokesperson stated:

> Companies want engineers who can write and speak concisely, effectively, and persuasively. Our graduates are unprepared for the vast amount of communication (writing and speaking) that they must do in industry. They must be able to communicate—not only with other engineers, but also with nonengineers.

Many engineering deans take exception to such criticism, saying that their graduates' communication skills are in line with those of graduates in other disciplines. They claim that the deterioration is, in fact, campuswide. But whether or not that's true, the problem is one that the engineering discipline must deal with.

Meanwhile, another problem faced by Schools of Engineering has grown progressively worse: How can a geometrically growing body of information continue to be efficiently and effectively taught?

Unlike the complaints about communication skills, this particular problem is by no means new. In fact, it was first addressed shortly after World War II, when several schools attempted to deal with the growing body of engineering information by lengthening the four-year undergraduate engineering program to five years. But because the move wasn't universally instituted, it quickly fell from favor. (With four-year graduates still viable on the job market,

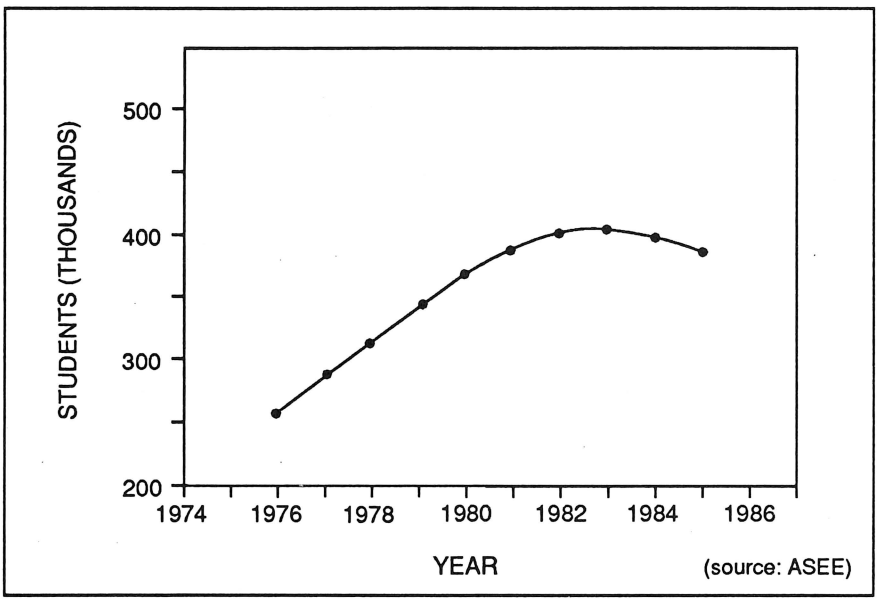
who would want to spend the extra time and money for a fifth year?) Today, very few schools take the five-year approach.

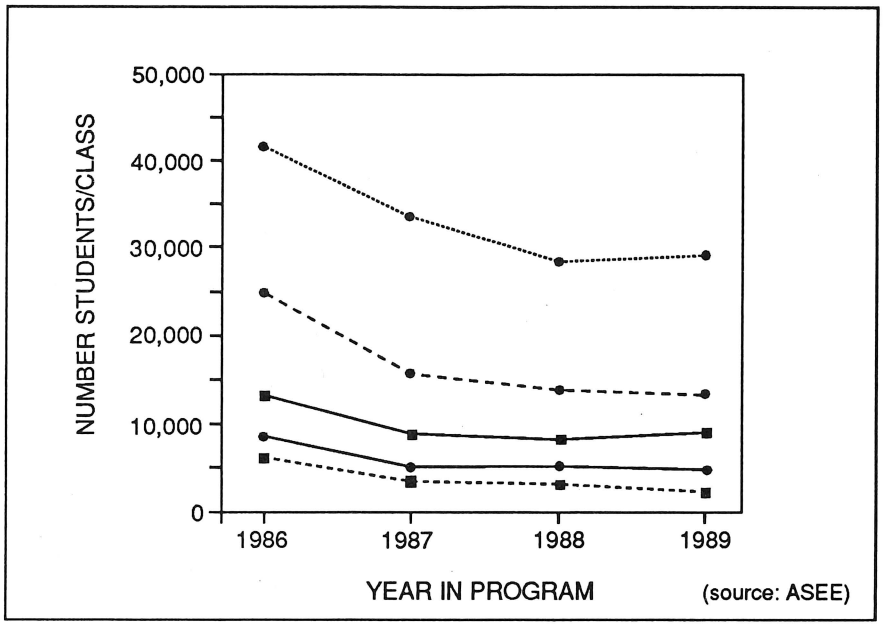
Institutions are attempting to sandwich an incredible bulk of information into four years.

The response of the institutions to the growing pressure has been an attempt to sandwich an incredible bulk of information into a four-year engineering curriculum. The students' response has been to stay at college longer. In fact, according to an article in *Engineering Education,* the average student takes 4.5 to 4.7 years to complete the program.

Another apparent student response has been to simply stay away. Engineering enrollments peaked with the graduating classes of 1985 and 1986 (students who began their studies in 1981 and 1982). Since then, each freshman class has been smaller than the last, in terms of percentage of total college enrollment in the various disciplines. And according to recent studies, the trend is expected to continue. As a result, demand for well-educated

Engineering Undergraduate Enrollments





Declining Enrollments in the Big Five

engineers is outpacing supply. Yet never before have engineering issues had such an impact on the life of the average person.

So what's a School of Engineering to do—faced on the one hand with pressure to retain or expand liberal arts offerings, and on the other with an increasing body of engineering information to impart? (And all this in only four years.)

Enter the Macintosh personal computer—a natural for engineering *and* liberal arts. Its graphics capabilities and ability to handle numeric computations make it a powerful tool for engineering tasks. There are solutions for performing complex system analysis, design tasks, data acquisition and analysis, modeling, and, of course, a variety of graphics tools. This large—and rapidly growing—body of available engineering software both attests to and extends the usefulness of the Macintosh. In addition, the Macintosh is a proven productivity tool, which can aid engineering professors with their mountains of paperwork, as well as with their classroom and research efforts. And the system's ease of use and consistent interface between applications make it efficient to use, because it requires only minimal training time.

The large—and rapidly growing—body of available software both attests to and extends the usefulness of the Macintosh.

Best of all, the Macintosh is well-known to be equally useful and efficient as a liberal arts tool, offering institutions a potential bridge between study of engineering and study of the humanities.

Hardware Advantages

Some of the reasons that Macintosh offers engineering educators an ideal platform for instruction and research are in the software, others are in the hardware, peripherals, and alternative operating systems. Let's examine some of the latter.

In a field as complex as engineering, no single computer can tackle every task alone.

In a field as complex as engineering, no single computer can tackle every task alone. Macintosh offers access to other industry-standard operating systems, including MS-DOS and UNIX. And it connects easily to other computers—from microcomputers to mainframes—whether they're down the hall, across the campus, or on the other side of the country.

With AppleTalk®, a powerful network system built into every Macintosh computer, you can connect as many as 32 Macintosh computers and peripherals with plug-together simplicity—and let a large workgroup share the desktop publishing powers of one LaserWriter® printer. With AppleShare™ software, and one Macintosh with a hard disk acting as a dedicated file server, everyone in a workgroup can have access to the same data. And with a variety of terminal emulation programs, Macintosh can become a window to the world of advanced graphics plotters, workstations, and mainframes.

You'll find Macintosh computers connected to just about any computer on the market.

Indeed, many engineering schools have already integrated Macintosh workgroups into existing campus networks. You'll find Macintosh computers connected to Sun and Apollo workstations, Hewlett-Packard plotters, and a variety of minicomputers and supercomputers—to just about any computer on the market—via Ethernet, fiber optics, or telephone wiring. And some of these Macintosh computers can be found in the classroom, offering students a chance to do computer-based tasks that would previously have required a class field trip to visit the campus mainframe.

For UNIX users, Apple offers A/UX™, Apple's version of UNIX for the Macintosh II. A/UX is based on AT&T UNIX® System V, Release 2, and incorporates key features from Berkeley's BSD 4.2 and 4.3 implementations, as well as support for TCP/IP and Sun Microsystems' NFS network protocols. Development languages FORTRAN, C, and SNOBOL are included. A/UX also offers programmers access to the Macintosh Toolbox, which creates interface options such as pull-down menus, multiple fonts, and dialog boxes. This means that programs written for A/UX can have all the familiar features—the "look and feel"—of other programs written for the Macintosh.

Engineers who use MS-DOS computers will also find Macintosh compatible. For example, any IBM PC or compatible can be integrated into an AppleTalk network with the LocalTalk™ PC Card. And with file conversion software such as MacLink Plus, data from many popular MS-DOS programs can be imported into the Macintosh environment, and enhanced with Apple Desktop Publishing capabilities.

Finally, many Macintosh programs can read and write data in such industry-standard formats as DIF, SYLK, IGES, and GKS—so file transfer between all kinds of computers can be done quickly and easily.

The newer Macintosh systems—the Macintosh SE and the Macintosh II—are also adaptable in terms of hardware capabilities, thanks to their expansion slots. The Macintosh SE has a single slot that can be used for a variety of cards, including an optional MS-DOS coprocessor. The Macintosh II comes equipped with six NuBus™ slots, for maximum flexibility. One slot is used by the video card, but the remaining five can be used to add a number of capabilities (many cards are available; many more are being developed).

The newer Macintosh systems are also adaptable in terms of hardware capabilities.

Schools of Engineering will find cards used for data collection and acquisition particularly significant. For example, National Instruments has developed a complete family of plug-in cards for IEEE-488 devices: analog-to-digital and digital-to-analog conversion, digital input/output, timing input/output, high-speed DMA data transfers, and Real Time System Integration (RTSI).

Data acquisition is a very important part of engineering; it's also one that can become much simpler with the Macintosh as part of the laboratory. For example, a product called MACONTROL makes laboratory data acquisition and control as easy as using a spreadsheet on the Macintosh. MACONTROL is a general-purpose data-acquisition system that allows students and faculty to collect, manipulate, analyze, store, and publish information from any instrument or sensor controlled from a host computer. And its accompanying product, the IDAC-1000, is an RS-232 peripheral that isolates the Macintosh from the instruments under its control. The user can specify which input channel or channels to sample and how often the samples are to be taken. Users also have complete control over the output devices. All sampled data is then written as standard text files for use by any of the data-analysis programs available for the Macintosh.

Despite all this complexity of operation, using the Macintosh to create a presentation with the data amassed remains a simple cut-and-paste operation. And in addition to its more widely recognized desktop publishing capabilities, Macintosh can also output results to a variety of industry-standard plotters.

Despite all this complexity of operation, using the Macintosh to create a presentation with the data amassed remains a simple cut-and-paste operation.

Case Studies

No matter how much you read about the suitability of Macintosh for engineering instruction and the advantages it offers, the heart of the story lies in what's happening on campuses across the country. The following case studies offer an exciting and diverse look at what four Schools of Engineering are doing with the Macintosh—and what the Macintosh is doing for them.

University of Iowa: Networking and Robotics

Enhancing Engineering Education Through Networking

Two years ago, the College of Engineering at the University of Iowa began work on an ambitious plan to develop a state-of-the-art network of computer workstations. The network, which became known as the Iowa Computer-Aided Engineering Network (ICAEN), was intended to offer students valuable experience with the latest computer technology.

The plans for ICAEN called for 100 advanced Apollo workstations, with 200 Macintosh computers serving as low-cost front-end processors for the Apollos. The Apollos were to be the "workhorse" computers, used extensively for research, while the Macintosh computers were to be used as productivity tools for publishing.

But that's not exactly how it worked out. Instead, the Macintosh systems have become the machines of choice for many of the students and faculty members. According to John Kuhl, associate professor of electrical engineering and computer science and ICAEN's faculty director, "We thought that the Macintoshes would be interfaces to the Apollos. But with the excellent Macintosh software, we see a consistent migration from the Apollos to the Macintoshes."

The Macintosh systems are connected via AppleTalk to each other and to the campus computing network.

At this point, ICAEN consists of some 65 Apollo workstations, 170 Macintosh Plus computers, and an increasing number of Macintosh II computers. All of the Macintosh systems are connected via AppleTalk to each other and to the campuswide computing network. Every faculty member in the School of Engineering has a Macintosh. Kuhl says the ease of use of the Macintosh has made some converts: "Faculty who were computer illiterate are now enthusiastic, productive computer users."

ICAEN is the second-largest engineering college network of its type in the country, but the computing power that it makes available to each student is unsurpassed—a situation that faculty feel has greatly enhanced the students' learning experience (as is evidenced by the story that follows). And according to Kuhl, "The Macintoshes are the backbone of our college computing effort."

For more information on Iowa's engineering network, contact:
ICAEN
3133 Engineering Building
University of Iowa
Iowa City, IA 52242

Making Robotics Affordable

Meanwhile, within the College of Engineering, Dr. Tzvi Raz had a problem. Part of his job as assistant professor of industrial and management engineering was to teach robotics. But robots are both expensive and hard to maintain, and Raz found it impossible to offer his students the sort of extensive experience with robots that he felt was essential to their learning.

When the Macintosh made its debut at the University of Iowa, Raz was far from enthusiastic—an attitude that was soon to change. As he puts it, "When they brought the Macintosh, I was not too happy. Now I wouldn't use anything else."

What made the difference? The realization that the Macintosh could be the key to enhancing his robotics courses. Working with his staff and Steve Wessels, manager of software development at the Weeg Computing Center, Raz developed an approach that provides his students with access to robotics applications that was previously impossible.

He wrote a program for the Macintosh that allows students to manipulate a simulated robot on the Macintosh screen. Students are able to program the simulated robot exactly as they would a real one, and to experience the same successes and failures that they would if they each had a robot to work with. And because the design makes full use of the Macintosh interface, students can use the software immediately and get results quickly.

Robotics students manipulate a simulated robot on the Macintosh screen.

One unique feature of the program is that students can enter robot instruction sets using either pull-down menus or the keyboard. "Keyboard entry input is essential for instruction because it helps to emphasize the importance of syntax in robotics," says Wessels. After selecting the robot type and entering the desired robot characteristics, students can perform "What if?" experiments quickly, optimizing time and efficiency. Robot characteristics can be altered easily, which permits students to compare robot configurations and types.

Justifiably proud of the project, Wessels says, "Professional robotics simulation packages took five to ten years to develop and were too complex and expensive for students to use. In six months, we were able to develop an excellent instructional counterpart."

For more information, contact:
Dr. Tzvi Raz
Engineering Department
University of Iowa
Iowa City, IA 52242-0001

Caltech: Engineering, Research, and Education

For Caltech, the development of the Macintosh SE and Macintosh II was the key to expanding the systems' use in engineering studies.

Although Caltech had been using the Macintosh for some time, the development of the Macintosh SE and Macintosh II was the key to expanding the ways in which Macintosh technology could benefit engineering studies. The following are synopses of a few of the Caltech courses and projects that currently utilize Macintosh.

Computation and Neural Systems

This is a new interdisciplinary option concerned with the study of problems arising at the interface between neurobiology, electrical engineering, computer science, and physics. The unifying theme is the relationship between the physical structure of a computational system (physical or biological hardware), the dynamics of its operation, and the computational problems that it can efficiently solve.

For one class in collective computation, a program that simulates a layered neural network that learns using back-error propagation was developed on a Macintosh SE. The program, which could take up to several hours to run on the SE, can also be run on the Macintosh II, in minutes instead of hours. This allows the simulation to be used within class assignments.

Concurrent Computing

One product of the Caltech Concurrent Computing Project is the Mac-CUBE, a Macintosh Plus-based "hypercube" parallel processor implemented using the AppleTalk network to emulate the hypercube topology.

A ray tracer that originated on the hypercube has now been ported to the Macintosh II, to take advantage of its increased speed and color capabilities.

A ray tracer that originated on the hypercube has now been ported to the Macintosh II, to take advantage of its increased speed and color capabilities. The ray tracer starts with a model of a three-dimensional scene and reproduces it in color, producing smooth-edged objects on a raster display. The resultant color picture appears almost photographic in quality. This software was shown at AppleWorld℠ '87 and EDUCOM '87.

The model specifies the location, color, and reflective properties of objects in space, building complex objects from simple primitives such as polygons, spheres, and cylinders. The ray-tracing algorithm works somewhat similarly to a camera; rays begin at the eye, go through each pixel to be displayed, and eventually end at their source (some source of light).

Electrical Engineering

In the field of electrical engineering, the Macintosh plays a key role in several courses. In the introductory digital electronics class, for example, it is used as a simple logic analyzer/simulator. Using a program called LogicWorks, the Macintosh acts as a digital circuit simulator. The current project is the addition of a Macintosh serial port to the parallel input/output TTL interface. This will enable students to capture data from the TTL breadboard and display it on the Macintosh, as well as allowing the Macintosh to output signals to the breadboard. It will even be possible to have part of a circuit working as a simulation on the Macintosh while part is working in hardware on the breadboard.

The current project is the addition of a Macintosh serial port to the parallel input/output TTL interface.

In EE 127, Error-Correcting Codes, the Macintosh is used to demonstrate the Reed-Solomon descending algorithm, which is central to the course. The software used was written in LightspeedC, and, in itself, provides a nice introduction to the algorithm.

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AppleLink: U0284

Drexel: Using the Macintosh to Provide Expanded Computer Opportunities

At Drexel, which is well-known for its computing ventures (particularly in Macintosh software development), the engineering department uses the Macintosh to help to deal with the logistics of scarce computer resources and plentiful students.

As a specific example, the department must teach some 3,000 students finite-element analysis. The technique is a difficult one to teach, and the actual analysis is both computer-intensive and time-consuming. Students design models using ideal shapes that approximate real structures. They then analyze these models to gain insight into the behavior of the real structures. But the key to the technique lies not in the analysis, but in the initial modeling.

Previously, the campus supercomputer was frequently overloaded during the design-and-analysis process, which limited students' access to computing power. But now, a Control Data program called Meta4 lets students design their wire-frame models—the most time-consuming and learning-intensive part of finite-element

Previously, the campus supercomputer was frequently overloaded, but now students do some of their work on the Macintosh.

analysis—on the Macintosh. And because Meta4 is also a terminal emulation program, students will be able to use their Macintosh computers to access ICEM, which runs on the school's Cyber 180 computer. The students will use this capability to turn their wire-frame models into solid models, which can then be further analyzed using the finite-element-analysis programs running on the Cyber.

This system is already partially in place and will be fully operational in the spring. Its major benefit is the ability to use the Macintosh to move the most time-consuming part of the process from a more expensive, limited facility to the personal computer. Donald Thomas, a mechanical engineering professor and the chair of Drexel's College Microcomputer Policy Committee, sums the project up neatly: "What is really going on here is that Drexel is using its supercomputer as a peripheral for the Macintosh."

For more information, contact:
Donald Thomas
College of Engineering
Drexel University
Philadelphia, PA 19104

Penn State: Macintosh in Teaching and Research

Associate Professor of Aerospace Engineering George Dulikravich received an Apple equipment grant in March. His research group, which is doing work on computational fluid dynamics, makes extensive use of the Macintosh.

The group's Macintosh systems are interconnected functionally by an AppleTalk network running AppleShare file-server software.

The group's Macintosh systems are interconnected functionally by an AppleTalk network running AppleShare file-server software. Group members are using Microsoft FORTRAN, QUED (Quality Editor for Developers), and a custom-written file interchange program called DVI (Device Independent), which was written in Microsoft FORTRAN. DVI is a graphics language with a set of routines that allows users to transform contour, grid, or polygon output from Cray, VAX, or Sun computers into Macintosh screen files or PostScript® files. Dulikravich's group also uses VersaTerm-PRO to communicate with other computers. Currently, many of the most sophisticated runs are done on the other systems, but most will be switched to the Macintosh II as soon as it arrives at the lab.

The research that is done in the lab ranges from advanced hypersonic aerodynamics to developing a reliable method for preserving the living tissue used in organ transplants.

The lab's research ranges from advanced hypersonic aerodynamics to developing a reliable method for preserving tissue for transplants.

"Letters to Mom"

Research this technical is best described by the people who are pursuing it. Unfortunately, when engineers talk about engineering, they are often intelligible only to other engineers. So we asked the members of Dulikravich's group to explain their work in a simple format—one that would give the other *Wheels* readers a chance of understanding. The format: a letter to their mothers about their lives at school. The results (slightly edited) follow:

Networking, Fluid-Flow Problems, and Productivity

Dear Mom,

Thanks for the Macintosh Plus, it's a terrific aid in my research. By the way, my research in computational fluid dynamics is going along fine. I'm developing methods for generating computational grids. These grids are essential for the numerical solution of complex fluid flow problems. But more about my Mac.

With VersaTerm-PRO, I can use the Mac as a terminal to the department's VAX.

As you can see, my Mac is a great word processor, but it's also much more. With the aid of a program called VersaTerm-PRO, I can use the Mac as a terminal that talks to the Engineering Department's VAX 11/785 (or any other networked campus computer) via phone lines or 9600-baud hard wires, or to the Sun 3/160 workstation that we have right here in the lab. With the Mac on my desk, I can develop programs using a superb editor called QUED. I can even run small cases using FORTRAN, or download my code to the larger computers for execution. My Mac also allows me to transfer files between the VAX and Sun using a program called Kermit. When the Mac is emulating a VAX terminal, I copy files from the VAX to Macintosh disks, and then while the Mac is emulating a Sun terminal, I copy the same files from the Macintosh disks to the Sun. This process also works in reverse. Without the Mac, these two computers would be isolated from each other.

Important to the development of grid generators is being able to graphically see what your grids look like as they're being built. Thanks to the creative programming of several guys here in the lab, I am able to take output from FORTRAN programs and plot it on my Macintosh. The bit-mapped structure of the screen allows me to cut and paste these displays for inclusion in technical papers and reports. The Macintosh has the best text/graphics editor I have ever seen,

The LaserWriter printer on our AppleTalk network produces beautiful output of my grids and technical writing.

making technical writing amazingly easy. And hard copy is also a snap. The LaserWriter printer we have on our AppleTalk network produces beautiful output of my grids and technical writing as well as simple listings of the programs I'm developing.

The bottom line, Mom, is that there's more to the Macintosh Plus than its good looks. It's simple to use and understand, but fits very well in the highly technical, "cutting edge" environment of our research lab. Thanks again for an extremely versatile research tool.

Love,

Jonathan Weiss

Hypersonics Code, Word Processing, and Terminal Emulation

Dear Mom,

At Penn State, I am currently working on a computer code that will predict the airflow about an aircraft moving at hypersonic velocity. Hypersonic is just a fancy word for flight at Mach numbers between 5 and 30. To get things in perspective, a 747 cruises at Mach 0.85, an F-14 Tomcat like in "Top Gun" can fly at Mach 2.5 but spends most of its time at Mach 0.8 or so. The Concorde cruises at about Mach 2.0. The fastest airplane in the world, the SR-71 Blackbird, flies at about Mach 3.5. The space shuttle reenters the atmosphere at about Mach 25. So the only hypersonic aircraft flying today are spacecraft and some missiles. Soon though, the United States wants to make an airplane—called the National Aerospace Plane (NASP)—that will take off from a conventional runway, like a conventional airplane, and fly into low-earth-orbit; i.e., fly into the same domain where the space shuttle now goes. Because of NASP, hypersonics is big business.

Unfortunately, hypersonics codes are very complicated, because they must incorporate chemistry equations as well as the traditional fluid-flow equations.

Unfortunately, hypersonics codes are very complicated, because they must incorporate chemistry equations as well as the traditional fluid-flow equations. In technical terms, the code is a three-dimensional, time-accurate, shock-capturing, full Navier-Stokes Equation solver with the ability to handle nonequilibrium chemical reactions and nonequilibrium vibrational energy. In addition, the equations governing electromagnetism and radiation have been added to the momentum and energy equations. The governing equations are solved using a MacCormack finite-differencing scheme with a predictor and a corrector step. Finally, multi-domains and solution-adaptive grid movements are possible.

Since I am working in computational fluid dynamics (CFD), by default I use computers every day. My life on computers is centered around an Apple Macintosh Plus. I use the Mac as a word processor, a text editor, a communications terminal, a FORTRAN compiler, and in conjunction with our Apple LaserWriter, as a hard-copy device for both text and graphics.

I use the Mac as a word processor, a text editor, a communications terminal, and a FORTRAN compiler.

For a word processor, I usually use a program called WriteNow. It allows me to have what-you-see-is-what-you-get editing, along with the ability to easily include graphics in my reports—which is a big plus in the business I am in.

For terminal emulation, I use VersaTerm-PRO 2.0. It is an incredible program that allows me to connect to any computer I want to. I routinely connect to the following computers: VAX 11/780, VAX 11/785, VAX 8550, VAX 8600, Harris HCX-7, Cray XMP, and Sun 3/160. The thing that makes VersaTerm-PRO really amazing is the way it adds Macintosh features to the computer it is currently logged on to. For example, I can cut and paste directly on the screen; I can save selections of text and graphics directly to disk; and I can scroll back through my previous screens. VersaTerm-PRO also supports five file transfer protocols, emulates a VT100 and both a Tektronix 4014 and 4015 graphics terminal, and has macros that allow me to condense many commands into one.

The thing that makes VersaTerm-PRO really amazing is the way it adds Macintosh features to the computer it's logged on to.

When I begin writing a computer program, I do not need the full power of a word processor like WriteNow, but I do need a fairly powerful text editor—in fact I need something that has some features a word processor does not have. The program QUED is my answer. It allows me to edit straight text files that can be sent directly to a compiler, but gives me the power of a word processor. It also has nice things like parentheses checking to make sure my parentheses are balanced. In addition, it allows me to edit many programs at once. This is useful when I am writing a program that has pieces in common with another program, or when I am examining compiler output looking for bugs. I can look at the output and edit my code as I find the bugs.

The FORTRAN compilers I use are Microsoft FORTRAN and MacTran 77. Both of these compilers allow me to compile FORTRAN code that I have created using QUED. Writing FORTRAN code is really a two-step process: first the code must compile, then the code must run and produce correct results. The compiling part is the step that the Macintosh can do—that is, the "edit-compile" debugging loop can be done on the Mac. Unfortunately, the Mac is not fast enough to run most CFD codes, so the "edit-compile-run" debugging loop must be done on a faster machine: the VAX, Sun, or Harris. When the code is completely debugged, I send it to the Cray to solve the actual full-size flow problems.

The FORTRAN compilers I use are Microsoft FORTRAN and MacTran 77.

(By full size, I mean with the arrays dimensioned to their full size and the number of iterations cranked up to whatever is necessary.)

As I mentioned before, I use the LaserWriter to output text and graphics.

As I mentioned before, I use the LaserWriter to output text and graphics. The text output is in the form of program listings, program output, and reports generated using a word processor. The graphics is in the form of simple xy-plots, contour plots, velocity vector plots, and grid plots.

The plots are generated using a family of programs that Steve Bova and I wrote called DVI. The center of the DVI program family is the "DVI plot file." The DVI plot file is a text file that is actually a representation of a picture; that is, a DVI plot file contains all the information needed to draw a picture. It contains this in a standard text format, and it can only make a picture if you know how to read it. This leads us to another part of the DVI family, the programs that read a DVI plot file. Every computer that we use (the VAX, Harris, etc.) has a program that reads a DVI file. This program reads the DVI file and displays it to the best of that computer's ability. The final member of the DVI family is the program DVILIB.FOR. It is a FORTRAN program that writes the DVI file. DVILIB contains FORTRAN-callable subroutines that a program can call to write a DVI plot file. Actually, we have written codes that link to DVILIB and produce certain types of pictures from output files generated by FORTRAN programs, with the information needed to draw the picture stored in the DVI plot file. Two of these codes are GRIDDVI and CONTDVI. GRIDDVI reads x,y grid data and creates a grid plot. CONTDVI reads x,y,ø data and creates a contour plot of ø. Programs like GRIDDVI and CONTDVI were written to help other people in the CFD lab take advantage of DVI without having to know anything about graphics.

The Macintosh is good at displaying data, but it cannot compete with a Cray when it comes to number crunching.

An example of DVI at work is the following scenario. I run my hypersonics code on the Cray at NASA Ames and generate reams of data. On the Cray, I also run GRIDDVI and CONTDVI to put my output data in easy-to-understand form, i.e., in graphical form. I now have DVI plot files that I "Kermit" down to my Mac. I then run DVIMAC, which displays the data on my Mac. If the data is good, I produce a hard copy on the LaserWriter using DVIPS (DVI PostScript). In this scenario, I have used each computer in its optimal way. The Cray is good at generating numbers, but not at displaying data. The Macintosh is good at displaying data, but it cannot compete with a Cray when it comes to number crunching. The thing that allows me to use both machines to their utmost potential is DVI; it allows me to transfer the data in a compact form, understandable by any machine.

In the CFD Lab, the whole Macintosh network is tied together using MacServe by Infosphere. It allows all five of the Macs to use the same hard disks for storage. Every user has a 4.75-megabyte segment of his own, and there is a 10-megabyte library of programs. We also use ComServe by Infosphere. ComServe allows us to connect our computer lines into all our Macs and share the lines between users. There is only one user per line, but we do not have to do any cable swapping because we use different lines.

In summary, what I have been trying to say is that at Penn State I am writing hypersonics code, and anytime I am on a computer, I am either running the Macintosh directly or am running another computer through the Macintosh.

Gotta run,
Alfred Lorber

Programming and Data Analysis

Dear Mom,

I just arrived at Penn State and have already started doing research. My research involves determining flow fields around arbitrarily shaped bodies. In particular, I am developing a code that solves the two-dimensional Euler equations, which is numerically stable and physically accurate. This work involves writing some large computer programs and analyzing the graphical output. Being accustomed to IBMs, I was surprised to see the number of Macintosh computers used in the Computational Fluid Dynamics Laboratory. I have found the Macintosh very versatile and easy to use. Software programs such as VersaTerm-PRO and DVI have made data manipulation a much easier process. Also, the Macintosh does not clutter up my desk the way the IBM does. Well, Mom, I have to run to class.

Being accustomed to IBMs, I was surprised to see the number of Macintosh computers used in the laboratory.

Your loving son,
Dan Dorney

Terminal Emulation

Dear Mom,

I am working on a method to speed up the solution of the Navier-Stokes Equations, that is, to speed up the solution of the equations that govern fluid flow. The method is known as Generalized Minimum Residual (GNLMR).

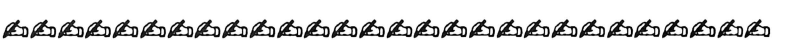
In Korea, my only experience with computers was working on large mainframes.

As a Korean citizen who first came to the U.S. in January of this year to obtain my Ph.D. in Aerospace Engineering at Penn State, many things were new to me. In Korea, my only experience with computers was working on large mainframes—and a friend of mine had an Apple II that he used mainly for data acquisition (though he did have some games). Upon joining Dr. Dulikravich's research group, I saw my fellow researchers using the Macintosh and asked them if they could show me how it worked. They gave me the Guided Tour disk and tape, and in no time, I was a competent Macintosh user. I am amazed at how easy the Macintosh is to operate—the operating system is so intuitive that I don't even know I am using an operating system.

I use the Macintosh mostly as a terminal emulator. I run VersaTerm-PRO and FullPaint. VersaTerm gives me the full features of any dumb terminal and also does an excellent emulation of a Tektronix 4014. Using the 4014 emulator, I save my plots as PICT files and then edit them using FullPaint. The LaserWriter is a fantastic printer. Its high resolution is very useful in analyzing my flow solutions.

In conclusion, the Macintosh is an amazingly versatile machine. I am only using two of its programs and am impressed with the amount of things I can do. I am looking forward in the future to learning to use a word processor, text editor, and FORTRAN compiler.

Seungsoo Lee



Terminal Emulation, Graphics, and Word Processing

Dear Mom:

Currently, I am working on a computational fluid dynamics computer program to design airfoils for turbomachinery compressors and turbines. The program can be run in either analysis mode or design mode. In analysis mode, it will find the Mach number, pressure, and velocity distribution throughout the flowfield for a given airfoil shape. In design mode, it will determine the best shape of the airfoil for a given Mach number distribution on the airfoil surface. Once the shape of the airfoil has been found, it can be used as input for the analysis mode to confirm the design.

I have enough trouble just getting my codes to produce correct results, so I don't need the additional hassle of using different machines as a mainframe terminal, graphics terminal, and word processor. The Macintosh performs all these functions by itself. I write my programs on the Mac locally using the multiwindow capability of QUED, and then transfer them to the mainframe using Kermit. I use VersaTerm-PRO to connect to the Penn State mainframe, as well as to computers located at other campuses across the country. VersaTerm-PRO is an extremely powerful and versatile program; it includes a DEC VT100 emulator, as well as Tektronix 4010 and 4014 emulators. The convenience of converting computer output to graphics and viewing the result without leaving my chair cannot be overstated. The amount of numbers generated by a typical CFD code is so great that it is often much easier to analyze the results by looking at plots than by looking at the raw numbers.

I have enough trouble just getting my codes to produce correct results, so I don't need the additional hassle of using different machines...the Macintosh performs all these functions by itself.

Since I use so many different mainframes, I have to know several different operating systems, such as VAX VMS, UNIX, and Cray COS. Furthermore, the Macintosh operating system is so easy to use that it provides a welcome relief from the amount of typing and strict grammar required by the other operating systems. The real beauty of the Mac is that I can run all these programs simultaneously using Switcher™: I don't even have to quit one to work on another. Now, that's efficiency! Finally, when it's time to write a report, I write it up at my desk using either MacWrite or WriteNow. All output, either text or graphics, is obtained from our Apple LaserWriter Plus. In fact, we used the capabilities of PostScript as the graphics standard when we developed our own in-house multidevice graphics library (DVI). The resolution of the LaserWriter far exceeds that of any comparably priced plotter, and it can produce beautiful graphics.

Steve Bous

These case studies and the examples of Macintosh use they contain are only a representative sample of work that is occurring in Departments of Engineering at many universities and colleges. All across the country, faculty members are facing their challenges—teaching, research, and writing—using the Macintosh and a variety of engineering software and hardware products. And in classrooms, labs, and campus computer centers at the same schools, students are gaining valuable educational experiences that would be impossible—or at least impractical—without the Macintosh computer. For more detailed information, please refer to the following resources.

Computer Engineering Resources

Curriculum Software Reference Guide

Apple has recently developed a *Curriculum Software Reference Guide* for engineering software. This guide is a tool to aid engineering faculty and administrators in understanding how Apple computers can help them be even more productive in their teaching and research. It includes 10 accounts of Schools of Engineering that have done exactly this, along with detailed descriptions of more than 30 sophisticated applications. It also contains a Software Solutions section that matches many of these solutions to today's engineering curriculum, making it easy for faculty to select the appropriate software for their needs. For more information, or to order the guide, contact your local authorized Apple dealer or Apple representative.

The CAD/CAM Journal

The CAD/CAM Journal is the first publication devoted to providing in-depth coverage of the world of Macintosh CAD/CAM/CAE. Published by Koncepts Graphic Images, a New York-based publishing firm, *The CAD/CAM Journal*'s regular features include evaluations of two- and three-dimensional drafting and design software, articles on communications and CAD products, hardware evaluations, and listings of new CAD/CAM/CAE products. The magazine is distributed to more than 20,000 design professionals in universities, engineering/architecture firms, and corporations. Subscriptions are $20 for one year (six issues), or $35 for two years (12 issues). For information on subscriptions, call *The CAD/CAM Journal*, at (212) 425-4441.

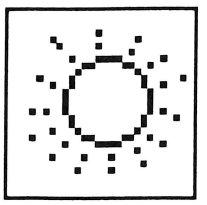
Other Publications

In addition to this dedicated publication, several of the mainstream computing magazines include at least an occasional feature on the use of the Macintosh computer in engineering. Among these publications are *Macworld, MACUSER,* and *Academic Computing.*

Additional Engineering Information in This Issue

More information on the use of the Macintosh in engineering instruction, study, and research can be found in the **Spotlight** and **Product** sections. In fact, the beginning of the **Product** section is entirely given over to information on engineering products.

Spotlight



The **Spotlight** section will focus on some of the Macintosh activities that are going on at various schools and universities. Typically, there will be two parts: the first will describe the activities that coincide with the theme of the issue; the second will be more general, describing a variety of interesting programs and activities. In this issue, the first article is a reprint (slightly edited) of an article that appeared in the European version of *Wheels for the Mind.* It is related to our topic of engineering instruction on computers, having to do with a computer science program at Sweden's Royal Institute of Technology that makes extensive use of the Macintosh personal computer.

Macintosh Activities in the School of Computer Science and Engineering

By Anders Hillbo and Yngve Sundblad, Royal Institute of Technology, Stockholm

The School of Computer Science and Engineering was started in 1983 as the tenth school of the Royal Institute of Technology, KTH, founded in 1827. Its four-and-a-half-year Master of Science and Engineering program has since 1983 admitted 60 students per year (90 in 1987). The curriculum consists of about 33 percent mathematics (calculus, discrete, applied), 30 percent software engineering, 18 percent hardware engineering, and 20 percent other subjects (physics, economy, and so on). The goal is to develop specialists—engineers with a broad and well-rounded knowledge of computer science.

An important part of that goal is to give the students experience with and the ability to use advanced programming tools and to develop powerful, user-friendly applications using modern technology. Already in 1983 when we were planning the program, we knew—from our research experience, especially in graphics systems, and from visits to universities and research laboratories in the United States—the importance and power of graphics workstations as a programming tool, especially for "visual" applications. But in 1983, the price of available graphics workstations was at least USD $25,000, which made it impossible to get such resources for extensive use for many students. With the release in February 1984 of the Apple Macintosh personal computer, this changed drastically; equipment based on the same ideas could be acquired for a tenth of that cost. Other important factors leading to our

An important part of that goal is to give the students the opportunity to develop powerful, user-friendly applications using modern technology.

rather massive venture into the Macintosh world were the truly consistent and user-friendly interface—supported with guidelines for programmers—and, of course, the document preparation facilities.

Examples of student use of the Macintosh include the following:

- Programming projects in MacApp™, developing true applications (see a description later in this article).
- Programming exercises, in which graphics play an important part, using C and Pascal.
- Preparation of documents containing plain text, graphics, and formulas, starting with tools such as MacWrite and MacDraw, but also with TeX and directly in PostScript.
- Use as terminals to our UNIX systems (see network map and section on strategy later in this article).
- Use of the MacScheme programming language, which is the main tool used in the first computer science course, for which the Scheme-based book by Abelson and Sussman will be used, starting this autumn.
- Use of other Macintosh productivity tools, for example, spreadsheets and database systems for easy handling of data from experiments in the physics course.

The doctorate program is centered around several laboratories that utilize the Macintosh.

The Doctor of Technology program in Computer Science and Engineering, which requires four years on top of the master's degree, is centered around several laboratories that utilize the Macintosh:

- CVAP, Computer Vision and Associative Pattern Processing, dealing with image analysis and pattern recognition.
- IPLab, Interaction and Presentation laboratory, dealing with human-machine interaction, especially with graphics workstations.
- Myprog, algebraic methods for specification of hardware and software.
- CSALab, Computer Systems Architecture laboratory, dealing with architectures for logic and functional programming.

Graphics workstations are, of course, used heavily also in those activities. In this description, though, we concentrate on use in education.

Computers

As described in the following Computer Strategy, our main goal is to combine traditional UNIX systems with the power of modern workstations, integrating them with networking. We now have about 60 Macintosh Plus and 35 Macintosh II computers, and 7 LaserWriter Plus printers. We plan to acquire a more powerful PostScript printer, such as the AGFA p400 or Texas OmniLaser.

Macintosh Networking

In order to integrate our resources, we have been closely following the development for Macintosh integration with the "outside." We first built a SEAgate (designed at Stanford University). Recently, we bought five Kinetics FastPath gateways. The network software we use is Stanford KIP, Columbia CAP, BBN/Lucasfilm EFS, and CMU MacIP. The present use is mainly LaserWriter access from UNIX and the simulated disk on UNIX. When Columbia's AppleShare for UNIX becomes more stable, we plan to use that in combination with standard Macintosh AppleShare.

When Columbia's AppleShare for UNIX becomes more stable, we plan to use that in combination with standard AppleShare.

Macintosh Program Development Tools

We have found it important for the students not only to use the Macintosh, but also to develop programs for that type of environment. At first, we mainly used conventional programming environments—first C on VAX (SUMac), then C on Macintosh (mainly Aztec). The tools of that kind that we mainly use today are the excellent LightspeedC and Lightspeed Pascal.

The department has a long tradition of object-oriented programming in Simula and uses Smalltalk and LISP-based systems on larger (Tektronix 4406, Xerox 1186, Symbolics) and smaller (Macintosh) workstations in research projects. Because of this, we have closely followed Apple's development of tools for object-oriented programming. In the autumn of 1986, we replaced Simula with Object Pascal and MacApp in the main course on programming environments, and also used it in the projects connected to that course, as can be seen from the following list of student projects in 1986/87.

Projects 1986/1987

Schema—Time schedules

By Karin Wallén, Ann Frisinger, Patrik Ernberg, Börje Lewin, Mia Agrell, and Lotta Eriksson

A tool for interactive production (on screen and paper) of "two-dimensional" time schedules, where the framework of hours and weekdays can be specified to produce a blank schedule for filling in one or several parallel activities. Developed in MPW (Object) Pascal with MacApp.

ANIMA—Animation of dance notes

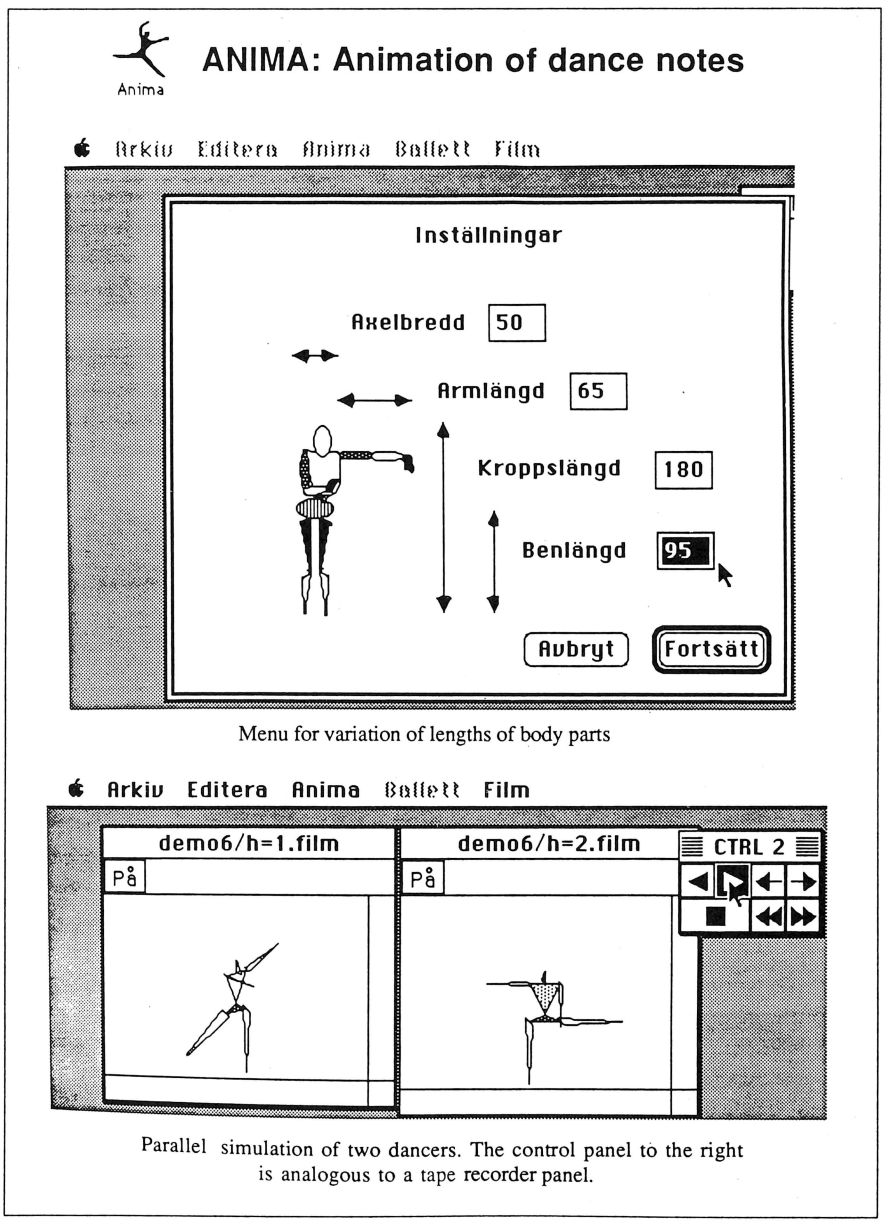
By Hakim LeRaqui, Robin Nilsson, Gustaf Nyman, Patrik Sellstedt, and Magnus Stensmo

From dance notes, a dancing sequence ("ballet") can be computed, shown on the screen, and saved on a file.

The dances can be stored in three forms:

- Numerically coded score.
- Information about the dancer's coordinates in time and space.
- A "film" with successive drawings of the dancer(s).

Developed in MPW (Object) Pascal with MacApp.



Menu for variation of lengths of body parts

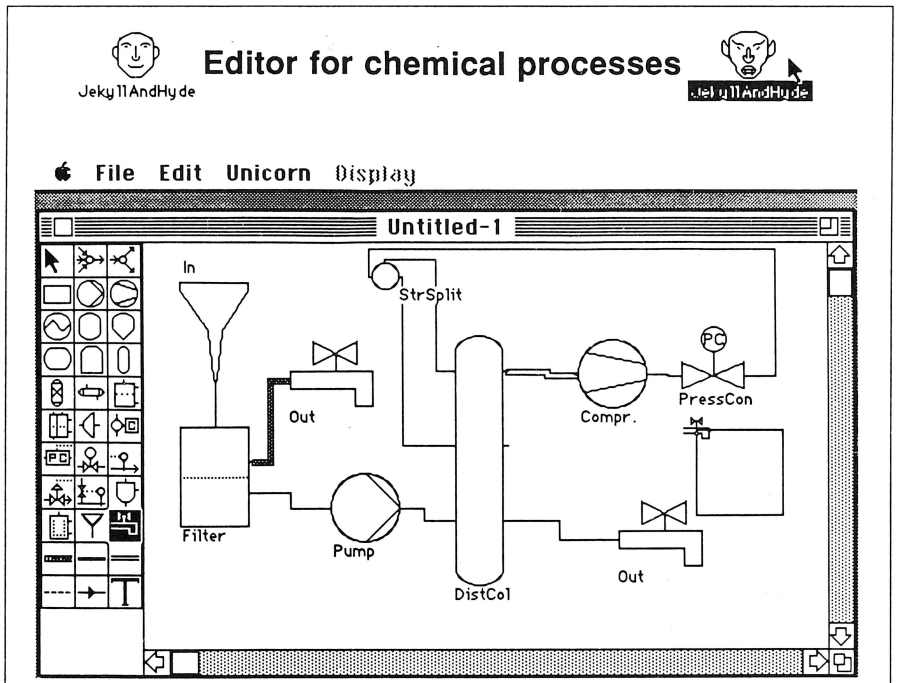
Parallel simulation of two dancers. The control panel to the right is analogous to a tape recorder panel.

Jekyll and Hyde—An editor for chemical processes

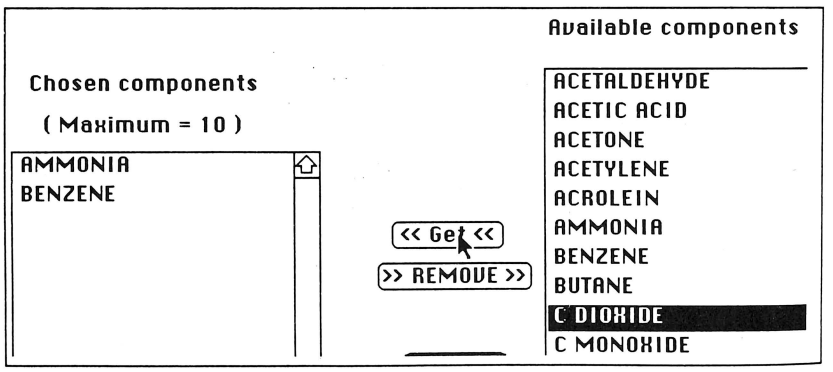
By Mikael Goldmann, Annika Haglind, Martin Kjällman, Anders Lind, Agneta Lindberg, Mikael Löfgren, Arne Ohlsson, and Peter Rosengren

With a graphics editor, chemical plant components can be connected and specified, together with compounds in the flow (with appropriate data). From the chart-input data to a standard simulation, programs are produced and sent to a mainframe computer. The resulting data are sent back, and the flows of compounds can be inspected by clicking in the chart.

Developed in MPW (Object) Pascal with MacApp.



A chemical flow under construction with the editor. An output tap is added (cursor has that form, rectangle shows space needed in diagram)



Choosing chemical compounds

The intention of the projects is to let the students develop tools that fully utilize the possibilities for a friendly human-machine interface.

The intention of the projects is to give the students the experience of developing applications (tools) that fully utilize the graphics workstation possibilities for a friendly human-machine interface. The development is made in close contact with users. Of special interest are applications developed together with other schools at KTH or other universities in Stockholm. Two such examples were described: the Jekyll and Hyde program for the School of Chemical Engineering at KTH and the ANIMA program for the Institute of Choreography. We intend to put special effort on that kind of cooperation in future projects—in part, because our students show special appreciation of it. Most of the projects nominally take two months of half-time work, but the students have in many cases been so keen that they have used considerably more time.

The Strategy Behind the Computer Environment

Introduction
The environment we want to give our students and researchers may be summed up in the following points:

- User-friendly and consistent systems.
- Modern interactive workstation environment.
- Computer communications.
- Standards.

We think it is very important that the future computer experts get to know the best systems, which we believe exhibit the following characteristics:

- A good programming environment—A stimulating and powerful environment makes a great deal of difference in the appearance of the resulting programs.
- Integrated computer communication—In order to distribute assets and spread expenses and information, computer networks will be very important in the future. And we believe that to fully realize the need for computer networks, you have to see an example of how they function.
- A good environment for the production of text and pictures—In the future, documentation of what experts within the computer area are doing will be more and more important. The resources available to produce text and pictures should not only give nice results, but also be stimulating to use.
- User-friendly systems—In the future, more and more people will get in touch with computers. Therefore, it is very important that tomorrow's computer engineers get good examples of these systems and receive the training necessary to produce them.

In order to attain these aims with our relatively limited economic and personal resources, we must have some fundamental principles concerning equipment and software environment. These may be summarized in two words: standards and cooperation.

Since the main cost in the computer world of today is software (bought or developed), the main thing is not to buy the fastest computers, but those best suited for the software you want to run. We want the software we use to have the following qualities:

- Able to run on various computers—This lets us buy different systems and still be able to move software between them.

- Available from universities—Software from universities works excellently for us. Using our own competence to evaluate (and perhaps make small modifications), it is possible to build up a very good environment. Examples are BSD UNIX, Emacs, and Common LISP.

- Commercially supported—If possible, with source code.

A fundamental factor for us is cooperation with American universities. They have extensive resources and very competent people for software and hardware development. If we could not get much of our software from them, it would be very difficult for us to reach our level of ambition.

A fundamental factor for us is cooperation with American universities.

Networks

Our aim is to integrate all our computers into networks: both the existing ones and, above all, the ones we will buy. (There is, in fact, no choice if your goal is to minimize your development of hardware and software.)

We plan to make use of the following network connections and protocols:

- Ethernet—The most widely used hardware that connects computers from different manufacturers. It predominates among the American universities.

- Internet Protocols (TCP/IP: Transmission Control Protocol and Internet Protocol)—The protocol standardized by DoD (Dept. of Defense in the USA), which permits transfer of files, mail service, virtual terminal, and more. It predominates among American universities. For example, it is used for connecting the different Ethernets to the so-called ARPA Internet.

  Because the DoD and the universities require TCP-software, it is available for many different computers, either supported by the producer or as a university product. Examples of producers with their own support are DEC (ULTRIX, TOPS-20), Sun, Apollo, Pyramid, Gould, Hewlett-Packard, Tektronix, IBM (VM/SP),

and Amdahl (UTS). Third-party support is also supplied for DEC (VMS) and IBM (MS-DOS). University software naturally exists first of all for BSD UNIX but also for Macintosh, Sperry, and many more systems.

- NFS (Network File System)—A industry-standard distributed file system. Available for UNIX and some other systems.

Operating Systems

It is essential for us to keep up with the currents in the changeable world of computers.

Considering the facts above, the choice was very easy. The dominating system at Departments of Computer Science at American universities is Berkeley UNIX (BSD) (mostly on VAX and Sun systems). This system is supported by the DARPA project as a standard OS (successor of TOPS-20). There is a large amount of software, and more software is continually made available for BSD UNIX. Furthermore, the UNIX News and Mail network, USENET, connects about 2,000 UNIX computers located across the United States, Europe, and Australia. It is essential for us to keep up with the currents in the changeable world of computers. Access to this medium is necessary, because many new programs are distributed and discussed here. In addition, BSD UNIX is the most widespread implementation of the TCP/IP protocol.

In certain cases, you want to work with an environment that is not UNIX-based (Smalltalk, InterLisp, Macintosh). In these cases, we have bought special systems, but we always require that the systems are well adapted to UNIX and that they can easily communicate with UNIX over Ethernet.

Window Management and Graphics

Ease of use and ability to survey a large amount of information is increasingly important in the computers of today. For this purpose, the "window" systems have been developed. With the help of good graphics and symbolic languages, these systems can facilitate communication between the user and the computer. We think it is very important that the students and the researchers get experience from using such systems. In this area, we are looking at X-windows and NeWS as alternatives to the proprietary window systems.

Machines

- Pyramid 9820: Multiuser system with BSD UNIX. Intended to be used for time-sharing and NFS-file service, and as a fast central computer/disk-resource for the workstation environment.

- VAX 750: Multiuser system with BSD UNIX. In spite of the high price/MIP, a necessary choice because of its extensive use at universities. A stable base system on which almost all software from the UNIX community can run without modification.

- Sun: Workstation with BSD UNIX, bit-mapped display, and window system. At the time of purchase, compatibility was considered to be the main thing; the cost of learning and adapting programs for a new OS is very high. Both Sun and its competitor Apollo are widely used in universities.

- Xerox 1108: Workstation with InterLisp-D. Uses a different operating system, but has, through its use at universities, good possibilities to communicate with BSD UNIX. We bought it for its excellent programming environment, which admits so-called Rapid Prototyping: a rapid development of software, in this case with very good potential to use the window system.

- Macintosh: Personal computer with window system. Traditionally, we have not used many personal computers, but Macintosh has changed this. This is, of course, because Macintosh allows us to do things that the bigger (and more rapid) computers that we have at our disposal cannot do. It can integrate pictures and words better than almost any other system. Other systems that can do approximately the same things are Interleaf (for Sun and Apollo) and Xerox Star, but they cost ten times as much. We chose Macintosh for the following reasons:
  - — It integrates a simple and consistent user interface that allows very powerful applications to be built. Apple (and Xerox) is still the only organization that has understood the necessity of giving guidelines about how applications should work. The benefit of a workstation window user interface is not really realized if you have different commands and philosophies in different applications.
  - — It allows users to integrate advanced graphics applications, pictures, synthesized speech, and music on an inexpensive machine. A large number of creative applications have also been made.
  - — It realizes the idea of a workstation in a cheap and powerful system.
  - — Quite a lot of American universities have chosen Macintosh as their recommended personal computer for students (at Dartmouth, 6,000 have been sold; at Boston College, 5,000; at Stanford, 2,000; and so on). A large number of programs and projects exist for the Macintosh. In the electronic-mail conferences—INFO-MAC (ARPAnet) and comp.sys.mac (USENET)—there are discussions and reviews of programs, as well as publications of new programs.
  - — A lot of work has been done in order to get Macintosh well integrated into networks with shared resources (for example, efforts made at many universities to connect Macintosh to Ethernet and UNIX computers).

Traditionally, we have not used many personal computers, but Macintosh has changed this.

Summary

This article covered many of the considerations that led the School of Computer Science and Engineering to make a strong commitment to use of the Macintosh personal computer in its Master of Science and Engineering program. Since the program's early days, the number of students involved and the complexity of the projects that they are undertaking has steadily increased. It is anticipated that this trend will continue, and that the students' learning experiences will be further enhanced by use of the more advanced Macintosh computers—and their expanded connectivity options.

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Case Western Reserve University: Microcomputer Lab

The hardware and peripherals are all linked via the AppleTalk network, so users can share the printing resources.

In keeping with its goal of providing high-quality information resources and information management to the university community, Case Western Reserve University Libraries opened a microcomputer lab on December 1, 1986. Accessible to students, faculty, and staff, the lab contains 13 Macintosh Plus units, each with an external 800K drive. Hard copy is provided by a bank of five ImageWriter II near-letter-quality printers and a LaserWriter printer. A sixth ImageWriter II is dedicated to a Thunderscan digitizing unit. The hardware and peripherals are all linked via the AppleTalk network, so users can share the printing resources.

The lab offers approximately 40 software packages from major vendors. Popular offerings include the latest versions of MacWrite, Microsoft Word, WriteNow, MacDraw, Microsoft Chart, Easy 3D, SuperPaint, Cricket Draw and Graph, Red Ryder, Microsoft Excel, StatView 512+, MacProject, FileMaker Plus, Omnis 3, Business Filevision, PageMaker, Adobe Illustrator, and Double Helix. In addition, 12 packages from the Kinko's Academic Software Exchange are currently available. On the hardware side, two nontraditional input devices are available for use: a Thunderscan digitizer and a MacVision unit. The Thunderscan unit will scan any input that can be run through the ImageWriter II. The MacVision unit accepts input of three-dimensional objects via camera, video recorder (with steady freeze-frame capability), videodisc, or other computers with composite video output.

Student monitors are on duty each hour the lab is open. Their primary task is to provide readily available assistance to users, but they also perform such duties as monitoring the LaserWriter output, troubleshooting hardware and software problems, performing periodic preventive upkeep on hardware, setting up first-time users with Guided Tour kits, and recording lab statistics.

These statistics create a profile of the lab's clientele and the software packages they use, providing information useful in planning for the lab's future development. Current statistics show undergraduates to be the largest user group, followed by graduate students, and finally, staff and faculty. Software use is well distributed: 52 percent of users employ word processing; graphics users follow at 20 percent; 15 percent of users bring in their own software; and 13 percent use database management, telecommunications, and integrated packages.

The libraries sponsor special events, such as a faculty/administration MEET THE MAC program, designed to introduce users to the lab facility. Figures from the recent summer semester strongly suggest that this less hectic period is used to explore more complicated software packages—such as PageMaker 2.0, Microsoft Word 3.0, and Omnis 3—in greater depth.

The lab has already served some 3,400 users and been used to produce more than 42,000 laser printouts. The heavy use has prompted the expansion of lab hours to include evenings and weekends, as well as the addition of a lab supervisor to oversee the monitors and provide ongoing, high-level training.

The lab has already served some 3,400 users and been used to produce more than 42,000 laser printouts.

Future plans include the addition of file-server software, the expansion of digitizing options, a LaserWriter Plus upgrade, a second lab site, and continuing offers of introductory and advanced workshops for users. The lab is viewed as an important tool for organizing the information needs of the university community.

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University of New Hampshire: DISCovery Computing Centers Enter Second Year

The program was started last year to encourage meaningful integration of computers into the UNH curriculum.

DISCovery is a campuswide program at the University of New Hampshire that makes computer hardware, software, and consulting available to students and faculty members. The program, a result of special state funding, was started last year to encourage meaningful integration of computers into the UNH curriculum through the use and development of computer-aided instruction. "The special quality of our program," says director Betty Le Compagnon, "is the energy that comes from making microcomputers widely available to our students, while, at the same time, encouraging our faculty members to develop courseware."

There are three DISCovery Computing Centers—located in a dormitory, a classroom building, and the student union. The centers are equipped with a total of 90 Apple Macintosh Plus computers and AT&T 6300 personal computers. Staffed by student attendants, the centers are open daily until midnight and some weekend hours. Documentation and software packages—word processors, spreadsheets, and programming languages, and graphics, modeling, and statistical analysis programs—are available. The software for the Macintosh computers includes MacWrite, Microsoft Excel, Macintosh Pascal, True BASIC, MacDraw, FullPaint, and STELLA. Students also use their own software and course-specific software provided by instructors.

One computer workstation in each cluster is adapted for wheelchair access. A Macintosh in the campus ACCESS (Accessing Career Challenges in Education Through Specialized Services) office is equipped with HEADMASTER, special controller hardware for students who cannot use the keyboard or mouse, and ENLARGE, software for the visually impaired.

A related program offers help for students who have computer anxiety.

There is also a mini-cluster of DISCovery computers at the TASk (Training in Academic Skills) Center. TASk offers help for students who have computer anxiety, and special tutoring for students who wish or need to learn to use a computer in a distraction-free environment. One of the center's goals is to get students to the point that they are comfortable enough with the computer to use the larger DISCovery clusters.

Any UNH student who has attended an introductory orientation session may use the DISCovery computers. Manuals and tutorial disks are available for students who have no previous experience with a particular program.

The DISCovery grant program assists UNH faculty members in acquiring the necessary hardware, software, and training for the development of CAI materials. Through projects funded in the first year, students can now make health-management decisions

based on real data; simulate expensive chemistry experiments; practice French, Russian, German, Spanish, and Latin grammar; simulate animal nutrition experiments; investigate the scientific method; and analyze digitized "pictures" of sound or vision patterns. As part of projects funded this year, students will participate in early modern French society, explore computer mapping techniques and spatial data analysis, and do bibliographic library searches.

Faculty members can "test-drive" DISCovery computers and software in the Faculty Software Library. There is a hands-on training classroom equipped with Macintosh and AT&T computers, and compatible printers and projection systems are available for classroom use.

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Pennsylvania State University: Medical Database

For the last eight years, in cooperation with the Executive Management Program at Penn State, Dr. Karl Stoedefalke has been building a medical database profiling the corporate American executive. This database currently includes statistics on 1,500 executives; it consists of 157,000 datapoints and is continuing to grow.

Dr. Stoedefalke and his staff (faculty, staff, and graduate students) collected this data through extensive testing administered in the Noll Laboratory for Human Performance Research. The database profile contains 105 variables for each executive, spanning a broad range of personal information, such as exercise tolerance testing, pulmonary function testing, blood chemistry, and lifestyle.

The database profile contains 105 variables, spanning a broad range of personal information.

Continued attempts were made to analyze this extensive database using the campus mainframe system, but results were minimal, mainly due to the transitory student population (along with the complex and inefficient requirements dictated by mainframe systems). A database of this magnitude and specialty will only be analyzed by physiology majors who are not computer experts and do not have the time to master complex computer systems.

It was Charles Ryan, supervisor of the Ergonomics Laboratory at Noll Laboratory, who suggested that Dr. Stoedefalke consider moving his database into a Macintosh. Ryan believed that a Macintosh could be configured as a powerful workstation to handle a large database, manipulate data very quickly, and be easy to master and maintain. To accomplish this, a variety of software and hardware capabilities would be needed, including a fast, truly relational database manager, strong statistical capability, a graphics package, and document processing software.

Ryan assembled a system centered around an Apple Macintosh SE with a 20-megabyte internal drive and an Apple LaserWriter printer. The database manager selected was Omnis 3 Plus. For statistical analysis, data is exported to StatView 512+, and for graphics, data is exported to Cricket Graph. Final document processing is currently done in Microsoft Word. The total package is a high-speed workstation that has the capability of maintaining a large database, can process data, and produce completed documents. Additionally, its compact size allows it to be easily transported.

According to Ryan, the assembled system has lived up to his expectations. It is fast, easy to use, and most important, allows one to analyze data in an almost infinite variety of ways. Group members are free from the burdens of mainframe database management, and their ability to analyze data is limited only by their ability to ask the right questions.

Today's new Macintosh software will allow everyone to analyze and view data in ways never before imagined.

It is anticipated that the current system will serve as a building block for future systems. As the database grows and is in more demand, the group may upgrade to an Omnis 3 Plus multiuser system. This will allow several people to access records, update the database, and perform data analysis simultaneously. Eventually, the plan is to add 19-inch monitors and take advantage of the new multitasking capabilities as they become available. Apple's development of the Macintosh II and SE has opened the door for the implementation of A/D converters that allow for the collection of data on-line. Today's new Macintosh software will allow everyone to analyze and view data in ways never before imagined.

A Macintosh-based system with supporting high-quality software and documentation currently represents the ultimate workstation tool. Simply stated, one can do more work in less time than can be done on any other computer—it is in a class by itself. Professors and researchers who need strong data manipulation capability, graphics, and document processing can now do it all at a reasonable cost, using a Macintosh-based system with Omnis 3 Plus and related software.

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Drexel University: New Courseware

Drexel University has an aggressive courseware development program, which continues to lead to new educational applications for Macintosh users. The latest software developed at Drexel includes the following:

- **CaseMaker** is a software package designed for creating and presenting case studies and accompanying questions. It poses questions to the students after they have read the case, and then permits them to choose from a number of responses and statements for their answers. Various reasoning explanations are presented if an incorrect response is made. If, after three tries, users have not successfully answered a question, they are given the option of obtaining the answer and the rationale for it. The CaseMaker application is a collection of up to ten CaseMaker documents. Each CaseMaker document can have up to nine cases. These documents are created in any word processor using a very simple template. The documents are then loaded into an empty CaseMaker application using a supplied utility.

- **Matchmaker** is a program that interactively presents, checks, and scores matching-type quizzes. To match words to definitions, the user drags the word to the definition on the screen. The user can then request that the program find and mark any incorrect pairings. This application allows the user to develop the matching questions directly on the Macintosh. A Macintosh window has 10 answers and 10 questions in 2 different boxes. The user matches the words with the corresponding questions, and the program can check the answers. In addition, the user can take advantage of clues by examining a clue window. This tool is useful for creating quizzes or individualized instructional materials quickly and easily.

This application allows the user to develop the matching questions directly on the Macintosh.

- **VLSI Magician** is a program that allows engineering students to do trial circuit layouts on the Macintosh computer. Completed designs can be downloaded to a VAX 11/780 host computer for further manipulation and implementation. With the increasing use of application-specific integrated circuits, the importance of proper training for computer scientists and electrical engineers in this area is very important. The traditional hardware costs for this training are very high. At Drexel, the VLSI circuit layout training is based on the MAGIC software package released by the University of California at Berkeley for the VAX 11/780 computer. In an effort to get the highest individual student involvement in the circuit design process, the VLSI Magician was developed to allow students to do trial circuit layouts on the Macintosh and then transfer them to a VAX using terminal emulation software. The VAX software does rule checking and circuit extraction.

- **The Small Tips desk accessory** is used to store and display "tips" or other useful information while running an application. Tips are editable in the desk accessory and can be deleted or added easily. The only limit on the number of tips available in the desk accessory is the space on the system disk. Included on the disk are:

  Apple Jargon Tips
  Fun Stuff Tips
  FileMaker Tips
  Small Tips
  Hardware Tips
  Space and Storage Tips
  Spreadsheet Tips
  Term Paper Tips
  Printing Tips

Drexel distributes these and other courseware packages nationwide through the Kinko's Academic Courseware Exchange.

Australian National University: Publication Tool Development

Software development continues at the Australian National University.

On the other side of the world, software development for the Macintosh continues at the Australian National University. Alpha-Beta is an application that assists authors in the production of indexes for documents written in MacWrite. Indexes that are produced automatically by a computer are often inadequate in that they tend to produce a concordance—a simple list of words and references—rather than an aid to the reader with explanatory phrases and cross-references. Alpha-Beta will save an author time in the production of basic word lists, and also offers editing facilities that can transform such a list into a useful index.

If you double-click on a reference, you will quickly see the index entry in context in the document; conversely, double-clicking a word in the document shows its corresponding reference in the index, or adds that word as a new keyword.

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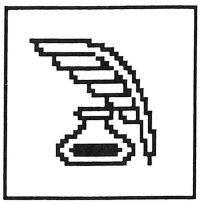
Reed College: Utility Disks for Students

At Reed College, two disks of applications and tools have been developed for students. Reed Applications I is intended for a general college audience. The disk provides a wide variety of applications and tools, including a terminal emulator, a MacWrite rescue utility, a speech synthesizer, mathematical programs for factoring and testing primality, the Billiard Parlour, the Juggler, and a ray-tracing program that draws reflective spheres over a checkerboard surface. The instructional format allows for both demonstration and example. The applications were developed using the Rascal Development System.

Reed Applications II is intended for college-level users in the general sciences, social sciences, and music. It has a wide variety of applications and tools, including a millisecond timer, a planimeter for measuring the area of irregular regions such as cells, a fast Fourier transform program, a signal-analysis program, a musical instrument synthesizer (with 17 instruments), a four-tone chord synthesizer, animation examples, a cellular automata model, and a Mandelbrot set. These applications can be used for problem solving, simulation, or demonstration.

As with many software packages developed at Reed, these applications are available through the Kinko's Academic Courseware Exchange.

News and Notes



The **News and Notes** section contains information of general interest to those in the Macintosh community. If you have information or know about events that you feel fit into this category, please send your news along.

Introducing Apple's Next-Generation LaserWriter Product Family

On January 15, Apple introduced its next generation, a complete family of three fully upgradable LaserWriter printers. The LaserWriter II product family provides Apple customers with a broad selection of laser printers. The approach is similar to Apple's CPU strategy: to offer a family of related products to meet a variety of customer needs.

The approach is...to offer a family of related products to meet a variety of customer needs.

LaserWriter II Product Family Overview

Family Traits
All LaserWriter II family members share the following features:

- A new compact design means that the LaserWriter II printers weigh less and are easier to handle than previous LaserWriter printers.
- The second-generation toner cartridge prints darker blacks and has a 25 percent longer life than the cartridges included with previous LaserWriter printers.
- The standard face-down output bin has forward collation of up to 100 pages, and an optional face-up output tray provides a straight-through paper path for heavier-gauge paper.
- A manual-feed slot—adjustable from standard letter width to envelope width—guides manual-feed jobs.

Family Specifications

Printing engine:	Canon LBP-SX laser-xerographic
Paper sizes:	U.S. letter, U.S. legal, A4, B5, and envelope cassettes. Paper cassette holds 200 sheets of 20-pound paper. Envelope cassette holds 15 envelopes.
Printing area:	Maximum printable line: 8.1 inches (205.9 mm); minimum top and bottom margins: 0.197 inches (5.0 mm); left and right margins: 0.197 inches (5.0 mm) (actual printing area may vary depending on the application)
Dimensions:	Height: 8.6 in. (22 cm) Width: 20 in. (51.3 cm) Width with letter-size cassette: 26.4 in. (67.8 cm) Depth: 18.5 in. (47.5 cm) Weight: 45 pounds (20.5 kg)
Speed:	Eight pages per minute maximum (actual speed depends on the images printed)
Duty cycle:	Minimum life expectancy is 300,000 pages with unlimited monthly output. Recommended service interval is 100,000 pages.
Paper handling:	Automatic with 200-sheet paper cassette. Face-down or face-up output trays. Manual with single-sheet feeder.
Printing materials:	16-pound to 20-pound photocopy or typewriter bond in normal mode; manual mode with face-up tray open. Accepts medium-weight photocopier transparencies. Envelopes can be printed with manual feed or from envelope cassette. Labels can be printed using manual feed.
Print quality:	All text and graphics printed at 300 by 300 dots per inch.

Product Availability

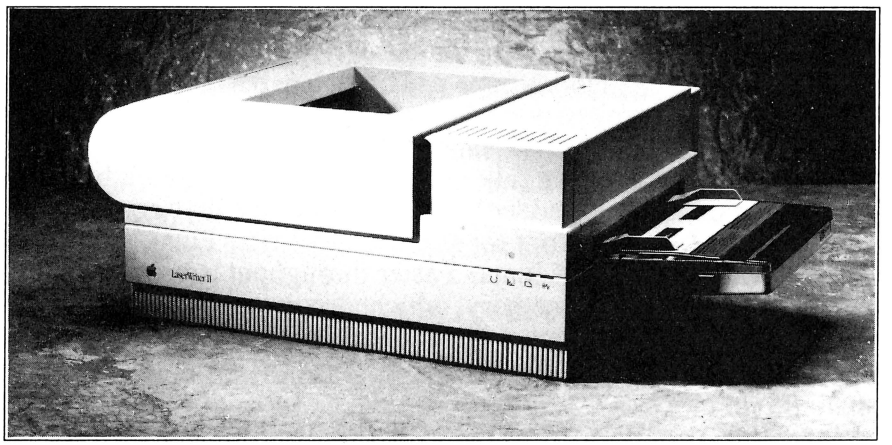
The LaserWriter IINT is currently available for shipment to customers. The LaserWriter IISC and LaserWriter IINTX will be available for shipment in February.

Product Positioning

- **The LaserWriter IISC** is an entry-level, single-user LaserWriter printer that can print full-page graphics and text.
- **The LaserWriter IINT** is the mainstream LaserWriter printer, designed to be shared on a network.
- **The LaserWriter IINTX** is a high-performance, expandable LaserWriter printer, designed for network use by people with rigorous printing requirements or for professional desktop publishing.

The LaserWriter II product family is designed to meet users' varying needs; the printers can be upgraded as users' needs change.

The printers can be upgraded as users' needs change.



Product Details

LaserWriter IISC—for general-purpose and basic desktop publishing laser printing

The entry-level, single-user LaserWriter IISC is designed for general printing, as well as basic desktop publishing. Based on a 68000 microprocessor, the printer provides high-speed performance. Its 1 megabyte of RAM lets the printer image a full page of text and graphics at a resolution of 300 dots per inch while maintaining high-speed throughput. High-speed data transfer for faster

The LaserWriter IISC is designed for general printing and basic desktop publishing.

printing is provided through the SCSI interface, which offers users the ability to daisy-chain as many as six additional SCSI peripheral devices.

Specifications

System requirements:	Macintosh personal computer with a minimum of 1 megabyte of memory connected to the LaserWriter via Apple SCSI cables
Processor:	Motorola 68000 processor (8-megahertz clock speed)
Memory:	8 kilobytes of ROM, 1 megabyte of RAM
Interfaces:	SCSI interface Apple Desktop Bus™ (ADB) port for future expansion
Fonts:	Times®, Helvetica®, Courier, and Symbol

The LaserWriter IINT—the mainstream LaserWriter for networked printing

The LaserWriter IINT is suitable for campus workgroups and complete desktop publishing.

The networking capabilities of the LaserWriter IINT make it suitable for campus workgroups and complete desktop publishing. The 68000 microprocessor provides high-speed performance, while the built-in AppleTalk support lets as many as 31 users share the printer over the AppleTalk network (and with network bridges, even more users can be added). The LaserWriter IINT comes with 35 typefaces (the same font set as the LaserWriter Plus), giving users a wide selection of fonts. Faster throughput is provided by 2 megabytes of standard memory, which also means that the LaserWriter IINT can handle more downloadable fonts than previous LaserWriter printers.

The LaserWriter IINT supports PostScript, the industry-standard page-description language, to offer sophisticated text and graphics capabilities. Many applications, both Macintosh and MS-DOS, support PostScript printing. And speaking of MS-DOS, the LaserWriter IINT offers a Diablo 630 emulation mode that ensures compatibility with MS-DOS systems, as well as an RS-232 port that provides easier connection for MS-DOS computers.

Specifications

System requirements:	One or more Apple Macintosh (minimum 512K of memory) or Apple IIGS® personal computers connected to the LaserWriter via the AppleTalk network. IBM PCs and other MS-DOS systems with a LocalTalk PC Card and the appropriate software. Any computer with the appropriate RS-232 cable.

Processor:	Motorola 68000 microprocessor (12-megahertz clock speed)
Memory:	1 megabyte ROM, 2 megabytes RAM
Interfaces:	AppleTalk and RS-232-C; ADB port for future expansion
Built-in fonts:	Times, Helvetica, Courier, and Symbol, ITC Avant Garde Gothic®, ITC Bookman®, Helvetica Narrow, New Century Schoolbook, Palatino®, ITC Zapf Chancery®, ITC Zapf Dingbats®
Printing protocols:	PostScript and a subset of Diablo 630 command set

The LaserWriter IINTX—for high-performance printing and professional desktop publishing in a networked environment

The LaserWriter IINTX is suitable for campus networks and professional desktop publishing.

The high-performance and expandable LaserWriter IINTX is suitable for campus networks and professional desktop publishing. Its 68020 microprocessor enables the LaserWriter IINTX to perform faster than previous LaserWriter printers. Aside from its faster processor, the LaserWriter IINTX shares many characteristics with the LaserWriter IINT: built-in AppleTalk support lets as many as 31 users share the printer over the AppleTalk network (and more users can be added with network bridges); 35 typefaces come standard; PostScript is supported; an RS-232 port provides easy connection for MS-DOS computers; and the Diablo 630 emulation mode ensures that MS-DOS systems can print easily.

But the LaserWriter IINTX offers quite a bit more. For example, its 2 megabytes of RAM can be expanded to 12 megabytes, offering the potential for further performance improvements. In addition to the Diablo 630 emulation mode, it offers a LaserJet Plus emulation mode. This means that it supports two of the most popular MS-DOS print drivers, ensuring MS-DOS compatibility. Also, an external SCSI connector allows the connection of an optional external hard disk for added font capabilities. Finally, the LaserWriter IINTX comes with a single expansion slot that can be used to increase the number of resident fonts.

Specifications

System requirements:	One or more Apple Macintosh (minimum 512K of RAM) or Apple IIGS personal computers connected to the LaserWriter via the AppleTalk network. IBM PCs and other MS-DOS systems with a LocalTalk PC Card and the appropriate software. Any computer with the appropriate RS-232 cable.

Processor:	Motorola 68020 microprocessor (16.67-megahertz clock speed)
Memory:	1 megabyte of ROM, expandable to 2 megabytes; 2 megabytes of RAM, expandable to 12 megabytes
Interfaces:	AppleTalk and RS-232-C; SCSI interface for dedicated mass-storage device; ADB port for future expansion
Built-in fonts:	Times, Helvetica, Courier, and Symbol, ITC Avant Garde Gothic, ITC Bookman, Helvetica Narrow, New Century Schoolbook, Palatino, ITC Zapf Chancery, ITC Zapf Dingbats
Printing protocols:	PostScript, a subset of the Diablo 630 command set, and Hewlett-Packard LaserJet Plus

LaserWriter II Questions and Answers

Why is Apple introducing a family of LaserWriter printers?

Apple's strategy is to provide a full range of printers to satisfy a variety of customer needs. The upgrade path—from the LaserWriter IISC to the IINT and IINTX—lets customers purchase an entry-level laser printer with the confidence that as their needs for performance grow, so can their printers' capabilities.

Will Apple continue to produce the LaserWriter and LaserWriter Plus printers?

Apple will continue to provide service and support for the earlier LaserWriter printers.

The LaserWriter II printers will replace the previous LaserWriter printers, which will be discontinued. However, Apple will continue to provide service and support for all products.

Can I upgrade my LaserWriter or LaserWriter Plus to the new LaserWriters?

No. The existing LaserWriter printers cannot be upgraded to LaserWriter II status.

How can I tell which LaserWriter II will best serve my printing needs?

The LaserWriter IISC is the entry-level LaserWriter printer, capable of full-page text and graphics. This printer is suitable for general printing needs and basic DTP, but it uses the SCSI interface and cannot be networked. The LaserWriter IISC also has some limitations in typeface variety and graphics power.

The LaserWriter IINT is Apple's mainstream laser printer and is similar to the LaserWriter Plus. It is a general-purpose, networkable laser printer that uses Adobe's PostScript page-description language. The LaserWriter IINT prints faster than previous LaserWriters because it features additional memory and a newer version of PostScript. The extra memory can be used for additional downloadable fonts.

The LaserWriter IINTX sets a new standard in desktop laser printers for speed and flexibility. This printer is best suited for large networked office groups and professional desktop publishing. Unlike previous LaserWriter printers, the LaserWriter IINTX is built around the Motorola 68020 microprocessor, which lets it print up to four times faster. It also offers a variety of expansion options: the internal RAM memory can be expanded from 2 to 12 megabytes; a Font Expansion Card can be internally installed to increase the number of internal fonts; and one or more SCSI hard disks can be attached for virtually unlimited font storage.

Unlike previous LaserWriter printers, the LaserWriter IINTX is built around the Motorola 68020 microprocessor.

What is Apple's complete current line of printers?

Apple's family of printers spans more than just the new LaserWriter II products. Apple's complete line of printers now consists of the following:

ImageWriter II	The best-selling printer in the country
ImageWriter LQ	Letter-quality printing with flexible paper-handling features
LaserWriter IISC	General-purpose and basic DTP laser printing
LaserWriter IINT	General-purpose and complete DTP laser printing in network environments
LaserWriter IINTX	High-performance, professional DTP laser printing in network environments
FaxModem	Fax printing that takes advantage of the full resolution of fax machines

How to Contact the Right People at Apple

Sometimes it is difficult to know whom to contact at Apple to get information about something that you are interested in. Moreover, even once you know *who,* it is often just as much of a problem to know *how.*

Sometimes it's difficult to know whom to contact at Apple.

The following list may prove helpful to you in your quest for enlightenment. The MCI and AppleLink listings are electronic-mail addresses. If you wish to use the good old U.S. Mail (always a sensible approach), include the mail-stop given in the chart, and send your letter to Apple Computer, Inc., 20525 Mariani Avenue, Cupertino, CA 95014.

- **Apple Programmer's and Developer's Association (APDA)**—Contact this group to find out about how to become a member or to order some Apple technical documentation and products.

MCI	AppleLink	Telephone	MailStop
312-7449	APDA	(206) 251-6548	N/A

- **Bug Report Center**—Send any bug reports on Apple hardware and software to this group.

Apple.Bugs	Apple.Bugs	N/A	27-AN

- **Customer Relations**—If you have any questions about Apple consumer promotions, updates, and upgrade programs, contact Customer Relations.

N/A	C.Relations	(408) 973-2222	23-AX

- **Authorized Apple Dealers**—If you wish to find the authorized Apple dealers in your area, call this toll-free number: 800-538-9696.

- **Developer Programs**—If you are a developer, you can contact Developer Programs for information on Apple mailings, address changes, equipment ordering, and general nontechnical support.

280-8699	DevServices	(408) 973-4897	27-W

- **Developer Tools**—If you are a developer, you can contact the Apple Tools and Compilers Group to suggest enhancements to Apple development systems.

Dev.Tools	Dev.Tools	(408) 973-6525	27-S

- **Evangelism**—Contact the Evangelism group for information about Apple's product strategies or to get started developing software and peripherals for Apple hardware.

272-8478	Evangelism	(408) 973-3289	27-AB

- **Human Interface**—Not surprisingly, this group deals with human interface issues.

299-3544	N/A	N/A	27-G

- **Macintosh Tech Support**—Contact the Macintosh Developer Technical Support group for answers to specific development questions.

215-0798	MacDTS	N/A	27-T

- **Software Licensing**—Contact the Licensing group for information about getting a license for System software and other Apple-proprietary software in order to legally ship it with your product.

  312-5360 SW.License (408) 973-4667 28-B

A Relationship Between Business and Higher Education: A Perspective on the 21st Century

By John Sculley
CEO and Chairman of the Board, Apple Computer, Inc.
A speech delivered at the EDUCOM Conference, Los Angeles, California, on October 28, 1987.

We are privileged to live during an extraordinary time. It is the turning of an era. The world is in passage from the industrial age to the information age. This is a time of profound changes, in which the key economic resources in the world will no longer be capital, labor, and raw materials, but rather knowledge, individual innovators, and information.

Technologies that are emerging today will give us the ability to explore, convey, and create knowledge as never before. This has enormous implications for us as individuals, as well as for our institutions. Our colleges and universities will take on especially heavy responsibilities as we make this transition.

Technologies emerging today will let us explore, convey, and create knowledge as never before.

We have an opportunity that is given only to few generations in history. I believe that if we respond with our best creative energies, we can unleash a new Renaissance of discovery and learning.

In our global economy, we are moving from a hierarchical order to one of interdependence. Not long ago, the United States stood unchallenged at the top of the world's economic hierarchy.

Drawing on the consuming power of an affluent population, this country built a strong industrial base. Our manufacturing companies added value to natural resources through technological know-how. Economies of scale favored the development of large, highly structured institutions.

Today, however, we are not at the top of a pyramid, but rather one node along a network. Our once exclusive know-how is available in many newly industrialized nations, such as Korea, Taiwan, Singapore, Mexico, and Brazil. What is at risk, as the United States loses economic primacy, is not simply our own standard of living, but also the health of the world economy. The global economic

system functions like a biological ecosystem. An unbalance in one sector can affect the whole.

A good analogy can be found in the shrinking rain forests of Brazil. Eighty percent of the world's oxygen comes from the Brazilian rain forests. Yet we lose, through the cutting of trees and the clearing of land, a land mass the size of the state of Nebraska, every year. If we keep doing that long enough, the decreasing amount of oxygen in the atmosphere will alter the entire ecosystem of the planet.

The United States participates in the world economy, not simply as a producer but also as a marketplace. If our population loses the ability to afford our own products, it also will not afford Japanese automobiles, electronics from the Pacific Rim countries, and so forth. And that would have a tremendous impact on the macro-economic ecosystem of the world.

Yet it is clear that as a nation, we are living beyond our means. We are no longer creating enough value to sustain our lifestyle, and we are falling deeper into debt. There is a compelling need to find new ways to continue to create value in the world.

I believe that our businesses and universities must be designed to foster innovation.

I believe that in order to do that our businesses and universities must be designed to foster innovation. Yet innovation has never come through bureaucracy and hierarchy. It has always come from individuals.

There is a dangerous timelag built into even the most successful institutions. They are created at one time in response to some particular opportunity in a given historical context. And then as the context shifts, the institution finds itself carrying excess baggage that is no longer useful.

How will the organizations designed to thrive in the 19th and early 20th centuries learn to contribute to the 21st? Only by reinventing themselves through refocusing on *individuals.*

The key strength of 21st-century organizations will be not their size or structure, but their ability to simultaneously unleash and coordinate the creative contributions of many individuals. Unleashing and coordinating may sound like contradictory actions. And in older models they would be. But we must develop new patterns of organization that promote alignment and collaboration while avoiding rigidity and stagnation.

Think of a jazz combo trading solos, versus a marching band in lockstep.

Communication in the new organization will be more fluid; action more spontaneous. Think of the speed and agility of basketball versus the massed force of football. Think of a jazz combo trading solos, versus a marching band in lockstep. The individuals who will succeed as contributors in these new organizations also need to change. In fact, change will be the one constant in their careers.

Overspecialization and a limited perspective can be a dead-end trap. Students today cannot count on finding one smooth career path, because, by the millions, the jobs that exist today will change radically tomorrow. Individuals will need to have tremendous flexibility to be able to move from one company to another, or from one industry to another. Those who are best prepared to do that will be the most successful.

We used to talk of "taking a position with the firm." Those are revealing words: *Position* and *firm* belong to a static model of rigid hierarchy. If you are only going to take one position, you can get by on only one point of view. In the information age, however, a diverse educational experience will be the critical foundation for success. What tomorrow's students will need is not just mastery of subject matter, but mastery of *learning*. Education will not be simply a prelude to a career, but a lifelong endeavor.

What tomorrow's students will need is not just mastery of subject matter, but mastery of learning.

Let me list some of the requirements of this new paradigm for lifelong learning:

- It should require rigorous mastery of subject matter under expert guidance.
- It should hone the conceptual skills that wrest meaning from data.
- It should promote a healthy skepticism that tests reality against multiple points of view.
- It should nourish individual creativity and encourage exploration.
- It should support collaboration.
- It should reward clear communication.
- It should provoke a journey of discovery.
- And above all it should be energized by the opportunity to contribute to the total of what we know and what we can do.

Higher education has traditionally defined itself in terms of two missions: instruction and research. In the past, these have been seen as very different activities. Research, which is primarily the domain of faculty and graduate students, is the process whereby we increase the world's store of knowledge. Instruction, which involves all students, is the process whereby we transfer some subset of that knowledge to *individuals*.

Higher education has traditionally defined itself in terms of two missions: instruction and research.

But, as we have seen, it is no longer enough to simply transfer knowledge to students. It is not as though we can give young people a ration of knowledge that they can draw on throughout their careers. Instead, we need to give them *access* to the unbounded world of knowledge. That means we must prepare all students, not just professional scholars, to embark on a journey of learning and discovery. Which means that our students will not simply be passively absorbing subject matter...but more like *researchers* actively exploring their environment.

To work in research is to recognize that knowledge does not reside *privately* in individual minds, or textbooks, or journals, or libraries,

or laboratories, or databases. Knowledge resides in a complex web that encompasses *all* of these.

To work in research is to recognize that knowledge is not static. Everyone in the research community shares the responsibility to test our knowledge and to enlarge it.

The challenge for higher education will be to find ways of bringing to the process of instruction the passion for discovery that drives research.

The challenge for higher education will be to find ways of bringing to the process of instruction the passion for discovery that drives research. Students today should master the skills and tools of research as part of their basic education.

To give our students this mastery, we must create a learning environment in which research and instruction are integrated.

I believe we all can make important contributions to that process. If we succeed, we will have found new ways of empowering individuals—not in isolation from each other—but with pathways for rich communication and effective collaboration.

The transformation I am calling for—shifting focus from the institution to the individual—has a close parallel in history. In medieval Europe, people were subservient to the institutions of the church and feudal hierarchies.

Then came the Renaissance, which redefined the individual as the epicenter of intellectual activity. It did more than change people's perspective of the world, it literally invented perspective. The medieval painter depicted great religious events with the most important figures appearing the largest. Composition reflected ideology. Then drawing styles changed. The Renaissance artist drew figures and buildings in perspective, the way they appeared to an individual observer. For the first time, point-of-view came into the world.

The many forces that converged to bring about the Renaissance galvanized around one key technology: printing. The rise of printing led with astonishing speed to an explosion of literacy. The result was a new self-esteem for the individual. A wealth of invention.

We are in need of a second Renaissance, which, like the first, can also be galvanized by technology.

An excitement of the power of wonderful ideas. We are, today, in need of a second Renaissance, which, like the first, can also be galvanized by technology.

We are on the verge of creating new tools that, like the press, will empower individuals, unlock worlds of knowledge, and forge a new community of ideas. These core technologies and the tools they support will help create a new environment of lifetime learning.

We believe that the tools that show the most promise for the new learning environment build on three core technologies: hypermedia, simulation, and artificial intelligence.

Each of these technologies alone can enrich the educational process. Each gains additional strength when learners can share resources over networks. And when these technologies are fully integrated with each other, they will fuel a 21st-century Renaissance—an outpouring of new learning and achievement.

Hypermedia is a new word for many of us. Yet this term and its definition will become increasingly important, the more we rely on personal computers to store, manage, and retrieve information.

Hypermedia will become increasingly important.

In broad terms, hypermedia is the delivery of information in forms that go beyond traditional list management and database report methods.

More specifically, it means that you don't have to follow a predetermined organization theme when searching for information. Instead, you can make instant choices about where to go next.

What this means for instruction and research is that content is not bound by particular choices of organization. Instead, content and organization become complementary tools that act on each other to deepen our understanding of the world around us.

Hypermedia lets us use a type of cross-reference that can be used to span courses that present related material, like physiology or microbiology. It gives us the capability to explore more deeply, linking one idea with another as the student or researcher pursues his or her own personal learning path.

In a sense, hypermedia is nothing new at all. A researcher using a card catalog and reference materials traditionally had the opportunity to pursue ideas according to insight and interest.

Hypermedia doesn't change that process, it merely *accelerates* it. It's a natural way of working, but until recently, personal computers were too limited to address it.

Today, however, desktop computers can have more information on-line than the largest mainframe managed 10 years ago. We are coming to expect high-capacity magnetic hard disks, optical media such as CD-ROM, and high-speed networks as standard in our installations.

Today, desktop computers can have more information on-line than the largest mainframe managed 10 years ago.

Established methods of finding related pieces of information seem cumbersome once we have experienced hypermedia.

Hypermedia can also be seen as a new form of publishing. There are now readily available tools that enable faculty in any discipline to create richly branching presentations. The major obstacles still to be cleared are not technological, but social and economic. We have not yet devised licensing procedures for the electronic formats of the textbook or journal abstracts.

We must all work together, through such forums as the EDUCOM Software Initiative, to address such issues as copyright and royalties, and access and security, in the information age.

The second core technology, simulation, pushes the boundaries of experimentation.

Just as hypermedia offers a new paradigm for exploring vast amounts of information, the second core technology, simulation, pushes the boundaries of experimentation. Simulation takes us beyond the "what" to the "how and why." We move from a static picture to dynamic visualization—from limited experience to diverse, multiple experiences.

The excitement in educational simulations today comes from generalized programs that allow professors and students to design their own simulations in particular disciplines, simulations that permit virtually all dynamic phenomena to be modeled and visualized.

Just as the spreadsheet allowed us to ask "What if?" questions about financial calculations, this new class of software allows those "What if?" questions to act on a dynamic graphics system, whether in physics, chemistry, electronics, or economics.

Simulation is also being applied to the humanities and social sciences.

Another new application of simulation is in the humanities and social sciences, not normally what you would think of as "computer-intensive disciplines." At Stanford University, a toolkit built on HyperCard has been designed in deference to a traditionally nonprogramming group: the humanities and social sciences faculty.

Using this toolkit, called ALIAS, professors or students in anthropology, history, or sociology can model a culture or period of history by entering their data into the toolkit. ALIAS will in turn create a HyperCard stack that allows a student to play the role of an individual of that culture. It is an approach that combines simulation and hypermedia.

In fact, this very simulation is currently being developed by Stanford professor Harumi Befu. It's called SHOGAI, which means "life course." To Professor Befu, SHOGAI means a new territory for his anthropology students; one in which they can explore the richness of Japan's people, its customs, and events, by assuming the roles of characters profiled in the simulation.

Using this simulation, students can make some critical decisions about school, social activities, and work that will collectively dictate Tadashi's niche in Japanese society. The point is to understand how and why the choices they make for him will determine the career opportunities he'll have and the social status he can achieve. As different choices are made, different results will unfold.

Simulation and hypermedia tools exist today. As they come into more widespread use, we will find two things happening. First, authors and publishers will continue to enrich our libraries of linked subject matter. And second, developers will continue to

make the underlying tools more powerful. We will have full, three-dimensional motion graphics, and stunning images on CD-ROM. But perhaps the most spectacular advance will be not in the presentation level, but will lie deeper in the programming.

Just a short way into the future, we will see artificial intelligence (AI) emerge as a core technology. Combined with our other core technologies, AI will boost simulations and hypermedia to new levels of realism and usefulness.

AI will boost simulations and hypermedia to new levels of realism and usefulness.

We will move, for example, from building molecules in two- and three-dimensional space, to building the environment in which they combine—where each molecule understands the structure and behavior of the others.

Another important contribution of AI will be intelligent agents that can learn a user's preferences and search strategies. These agents will transform the nature of academic computing. Agents will be sent to prowl among remote databases and bring back the specific information and citations that you require.

These future systems are not that far away. Soon, faculty and students will be using systems that enable them to drive through libraries, museums, databases, or institutional archives. These tools won't just take you to the doorstep of these great resources as sophisticated computers do now; they will invite you deep inside its secrets, interpreting and explaining—converting vast quantities of information into personalized and understandable knowledge.

I think we have only begun to see what innovation and creativity can produce in this industry.

In his keynote address at last year's EDUCOM conference, Dr. Herb Simon, professor of computer science and psychology at Carnegie-Mellon, said, "We think of revolutions as being sudden events, producing far-reaching changes in a very short period of time. But the revolution launched by the steam engine took, by any reasonable account, 150 years." Changes in computing have been like a whirlwind in the last 40 years. But I think we have only begun to see what innovation and creativity can produce in this industry.

The personal computer could become as galvanizing as the printing press in stimulating change in the world, in creating an environment for innovation and new ideas.

Let us remember that the printing press never wrote a single book. Authors write books. So, too, with the new technologies that I have described today. This will only be achieved if we work together—universities, corporations, and government—and if we recognize the role of the creative individual within these organizations.

We all have a role in making this vision of the future a reality. The technologies I've talked about today are only platforms that represent opportunities and possibilities. They are, however, the

tallest of platforms, the richest of opportunities, and the broadest of possibilities that I know of.

They will allow us to set loose an avalanche of personal creativity and achievement. Once we have thousands and thousands of ideas to harvest, we may have the chance once again to create a second Renaissance, perhaps every bit as important as the first, in the early part of the next century. It would represent a rebirth and revival of learning and culture unleashed by new technologies. It would bridge the gaps between the arts and sciences. And it would signify the emergence of an integrated environment for instruction and research.

It's an exhilarating time to live. I can't think of any other time in history in which such profound change has gripped each decade. The next 12 years promise to be an eventful journey to the 21st century. And there's no place that journey will be more exciting than in higher education.

MacHack 1988

The goal is to provide advanced developers with a full spectrum of information and support.

The third annual MacHack developer's conference for the Apple Macintosh computer will be held June 15–17. The aim of this conference, which is sponsored by the University of Michigan School of Education and MacTechnics, is to provide advanced developers with a full spectrum of information about hardware and software development tools, as well as highly technical support. Topics at this year's conference will include the following:

- Hardware and Engineering
- Artificial Intelligence and the Macintosh
- Languages and Tools
- Incorporating Color into the Macintosh Interface
- Support, Documentation, and Beta Testing
- International Programming
- University Courseware Development

Urgent Call for Papers

Abstracts of between 100 and 300 words describing your paper on the above topics are requested (preferably by February 1). Authors are invited to submit abstracts of their proposed technical papers to MTC - MacHack at the contact address given. MTC - MacHack will cover the full cost of the conference for presenters of papers ($250 before May 1; $275 after).

For more information, contact:
Aimée Moran, MacHack 88
Expotech, Inc.
1264 Bedford Road
Grosse Pointe Park, MI 48230
(313) 882-1824
ARPAnet: aimee_moran.um.cc.umich.edu
CompuServe: 72000,400
GEnie: expotech

Computer Law Education Conference

The conference will explore new technologies to assist legal educators.

The Franklin Pierce Law Center and Apple Computer are cosponsoring a two-day conference, March 10 and 11 in Boston, at the Quality Inn Downtown, for educators who are developing and using computer technology in teaching legal concepts, or setting up computer learning facilities. The conference will explore and demonstrate new technologies to assist legal educators in teaching students and preparing them to use these technologies in their practice of law. Additionally, attendees will acquire some skills that will assist them in augmenting their legal curricula, as well as getting some practice with computer hardware and software. Topics to be covered at the conference include:

- Planning for Computers in a Law School Setting
- Selecting Packaged Educational Software
- Planning and Developing Legal Courseware
- Using Computers for Legal Research and Writing
- Selecting Desktop Publishing Equipment and Software
- The Law Office of the Future: Automating Clinical Programs

For more information, contact:
Donna Edwards
Franklin Pierce Law Center
2 White Street
Concord, NH 03301
(603) 228-1541

Macintosh Courseware Catalog

The Macintosh Educational Software Collection, by Chariot Software Group, is the first mail-order catalog devoted exclusively to educational software for the Macintosh. The benefits of this catalog are twofold: it keeps educators informed about good, educationally oriented Macintosh software, and it improves the availability of these programs.

The catalog contains a full range of programs—from best-sellers to hard-to-find courseware.

The first issue was mailed to approximately 20,000 educators in September and has received an excellent response. The catalog will be published quarterly and contains a full range of programs—from best-sellers to the hard-to-find titles written especially for education. The current catalog has been expanded to include more than 70 quality software products, which range from Typing Made Easy, an introductory keyboarding course that teaches touch typing, to The Worm, which deals in detail with the digestive, nervous, circulatory, reproductive, and locomotive systems of the common earthworm.

The catalog is divided into 12 categories: Administrative, Business, Geography, Graphics, Idea Processors/Outliners, Math, Miscellaneous, Music, Programming, Science, Typing/Speed Reading/Vocabulary, and Word Processors/Desktop Publishing. It will include curriculum, productivity, and administrative software, and will be most useful for high school and college teachers.

Interested teachers can obtain a free copy by contacting Chariot. All programs are covered by a 30-day return policy and are priced at or below publisher-set retail prices.

For more information, or to order a copy, contact:
Chariot Software Group
3659 India Street
San Diego, CA 92103
800-CHA-RIOT; or in California, (619) 298-0202

Call for Physics Instruction Papers

The Conference on Computers in Physics Instruction is being held August 1–5 at North Carolina State University in Raleigh. The conference involves the use of computers in precollege, undergraduate, and graduate physics instruction. The program will offer invited and contributed papers (refereed), poster sessions, and formal and informal hands-on computer demonstrations. Each participant will receive the book of contributed papers, the book of invited papers, and sample software programs. The conference fee is $150 per person. Proposed topics include microcomputer-based

laboratories, interfacing, programming languages, computational tools, computer-aided instruction, and teaching strategies using computers. The deadline for submission of papers and software is March 1, 1988.

For further information, contact:
John S. Risley
Department of Physics
North Carolina State University
Raleigh, NC 27695-8202
(919) 737-2524
BITNET: RISLEY@NCSUPHYS

Software Donations Requested for NASA Aerospace Education Services Project

Software for Aerospace Education: A Bibliography, by the NASA Aerospace Education Services Project at Oklahoma State University, will publish its second issue in October 1988. This bibliography is prepared for the NASA Educational Technology Office, Education Affairs Division in Washington, D.C. The bibliography contains aerospace, astronomy, aeronautical, and physics software programs pertaining to aerospace education. The information compiled on each software package includes a written description, system and hardware requirements, cost, and educational information. Upon publication, the bibliographies are placed in the Teacher Resource Centers located at each of the ten NASA Field Centers, and they are distributed free to the recipients by the 27 specialists who present programs to schools throughout the country.

The bibliography contains aerospace, astronomy, aeronautical, and physics programs.

In order to better reflect current products and to learn about new software, NASA invites aerospace software developers to participate in the project by donating any software (with accompanying information) that would be appropriate for this type of bibliography. After the software is reviewed, it will be placed in the Department of Aviation and Space Education Teacher Resource Center Library at Oklahoma State University.

For more information, contact:
Dr. Susan K. Roth
NASA Aerospace Education Services Project
300 North Cordell
Stillwater, OK 74078

MacAdemia Update

This year, MacAdemia℠ will be held June 1–3 in Philadelphia, Pennsylvania. The event, which will spotlight hypermedia, is being cosponsored by Drexel University and the University of Pennsylvania.

Registration will take place on Wednesday, June 1, between 3 and 6 P.M. The actual conference, which will feature some enhancements to the event's tradition, will begin on Thursday. The morning sessions will be longer and will allow for in-depth presentations on three subjects. Two-hour blocks have been established for presentations on connectivity, hypermedia, and courseware, and hypermedia and desktop presentations. In order to accommodate everyone, those presentations will be repeated. Many additional one-hour breakout sessions have been provided for the balance of the day, as well as the entire day on Friday. And as a special conference event, on Thursday, the Franklin Institute has been reserved for an evening that will include dinner, exploration, and a special Apple presentation.

One of the goals of this year's MacAdemia is to explore new ideas and new technology. HyperCard and the entire new field of hypermedia will allow us to go where we have never gone before.

More information will be available around April, but in the meantime, please reserve those dates. If you have any suggestions about speakers or topics you would like included, please link Sperber1 or Simonet1, or drop us a note at Apple Computer, 3 Greentree Centre, Suite 202, Rt. 73, Marlton, NJ 08053.

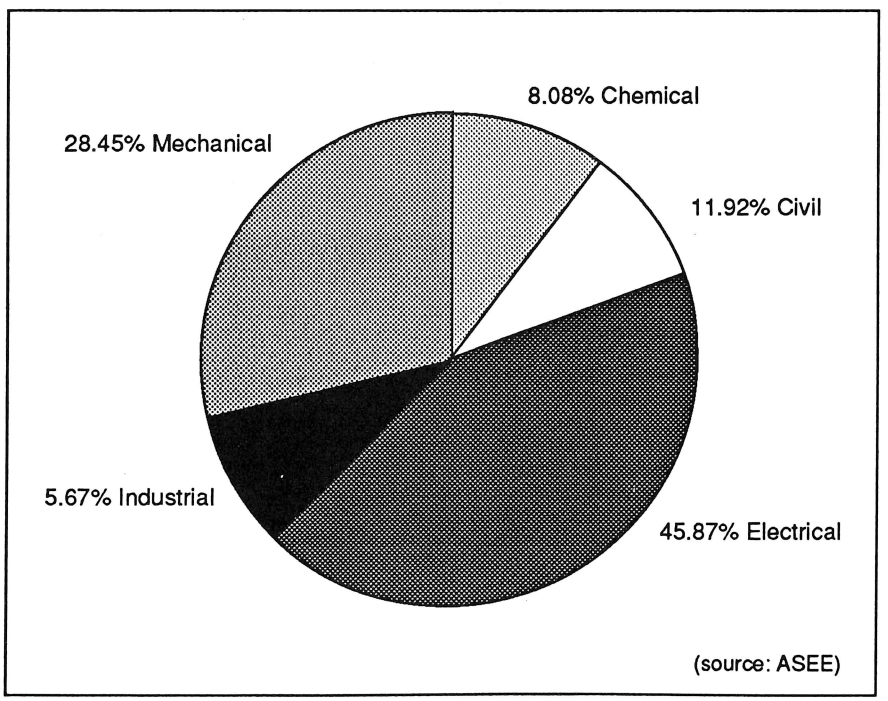
Products

The **Products** section highlights new or unusual products or uses of existing products that are of interest to the academic community. In this issue, the first part of the Products section deals with a number of the engineering products available. The second part consists of information on a wide variety of products.

Please send in suggestions about products that you think are worth publicizing to your colleagues in higher education.

Engineering Products

Although there are more than 20 recognized engineering fields of study (ceramic, bioengineering, and aerospace, for example), five major disciplines account for approximately two-thirds of all undergraduate study. The "Big Five" are electrical, mechanical, civil, chemical, and industrial engineering, with electrical engineering by far the most popular.



Innovative Machintosh applications are available for all engineering disciplines. The following is a listing of some of this software, along with a brief description of each.

Electrical Engineering Applications

This program offers a unique approach to electronic-system design.

DesignScope

DesignScope offers a unique approach to electronic-system design. Students connect the program modules into a system block diagram, assign parameters, and run a simulation of the new system to view waveforms—all without knowing component values in advance. Parameters can then be changed in seconds for a new simulation run. In addition to the waveforms, students can see filter responses and fast Fourier transforms (FFT). This makes DesignScope ideal for in-class presentations: now you can concentrate on generating systems and illustrating the dynamics of the design task at hand. DesignScope features a unique top-down approach that can greatly enhance the teaching and learning of circuit design.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: BrainPower, Inc., 24009 Ventura Blvd., Calabasas, CA 91302; (818) 884-6911

These programs simulate digital designs.

LogiMac and LogicWorks

LogiMac and LogicWorks simulate digital designs using the graphics capabilities of the Macintosh personal computer.

LogiMac...

- Was designed for students, teachers, and designers who create, test, and document logic circuits.
- Offers menus of standard symbols for digital logic devices and an easy-to-use drawing interface for quickly creating circuit diagrams. It includes the following devices:
  —Common gates, such as AND, NAND, and NOR.
  —Flip-flops (D and JK).
  —Shift registers.
  —Decoders.
  —Multiplexers.
  —Adder.
  —Three-state buffer.
  —Several I/O devices, including switches, probes, keyboard, and display.

- Provides live simulations of the circuits, taking into account:
  —Device delays.
  —Clock frequency.
  —Unconnected outputs.
  —Conflicting outputs.

- Produces drawings that can be copied into MacPaint for use in other documentation.

LogicWorks is a functionally richer version of LogiMac. It includes the ability to add your own device libraries, support for PLAs and PROMs, and improved diagram editing ability.

System Requirements: Any Macintosh system
Contact: LogiMac is available through Kinko's Academic Courseware Exchange; LogicWorks is available only from Capilano Systems, 1168 Hamilton Street, Suite 501, Vancouver, BC V6B252; (604) 669-6343

Signal Operations

This program offers a low-cost way for students to experiment with discrete signal analysis.

Signal Operations is the first part of a three-module package called Discrete Signals and Systems (the other modules are Transforms, Windows, Modulation and System Operations). Signal Operations is similar in scope to Transforms, Windows, Modulation. Files created in each program can be read by the other, so the programs complement each other; however, Transforms, Windows, Modulation works on complex data, while Signal Operations is limited to real data. The Signal Operations module is a low-cost way for students to experiment with a unique, interactive, graphical perspective on discrete signal analysis. The environment is interactive and promotes exploration of the concepts, while the Macintosh handles the computations involved.

System Requirements: Any Macintosh system
Contact: Signal Operations is available through Kinko's Academic Courseware Exchange Program.

Mechanical and Civil Engineering Applications

These programs are color CAD packages for the Macintosh II.

Design Dimensions and Solid Dimensions

Design Dimensions and Solid Dimensions are color computer-aided design (CAD) software packages for the Macintosh II computer. Design Dimensions is a three-dimensional color CAD system that offers design features typically found on minicomputers and mainframes. Solid Dimensions is a solid-modeling package that allows full viewing and rendering of an object with color shading and ray tracing. Dimensions can render true color images with walk-through viewing capabilities, standard models, and predraft drawings that can be transferred to two-dimensional engineering packages.

New DXF transfer software lets you examine and display image data between Design Dimensions, the Macintosh Clipboard, and AutoCAD. This enables current AutoCAD users to enhance their design options and utilize color.

For more information on any of these products, contact: Visual Information, Inc., 16309 Doublegrove, La Puente, CA 91744; (818) 918-8834

This program lets you analyze, design, and study any two-dimensional frame, truss, or beam.

FRAME MAC

FRAME MAC makes it possible to use the Macintosh to analyze, design, and study any two-dimensional frame, truss, or beam. Any number of nodes, supports, elements, and loads (including node, element, sloped, moments, and trapezoidal) can be added, limited only by RAM. Double-clicking on a node or element allows that item to be changed, and multiple nodes and elements can be changed in groups. Each node may be free or restrained in any direction. The program shows original and/or deflected shapes, load values, and more. Other windows can show any node as a free body, with all loads acting on it, or the user can show elements with loads, tension, shear, moment, and deflection. The program also includes part of the section tables from the American Institute of Steel Construction's steel manual. Tables can be changed or added to, and new tables can be created for other materials such as wood. In addition to FRAME MAC, BEAM MAC II is available to analyze any continuous or simple beam or column. A third product, BEAM MAC, is ideal for analysis of simple beams and columns. Compuneering Inc. also carries COGO MAC, a program for calculating the structural properties of shapes.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: Compuneering Inc., 113 McCabe Crescent, Thornhill, Ontario L4J 2S6, Canada; (416) 738-4601

MacElastic and MacPoisson

These programs let you perform some very sophisticated analysis.

MacElastic is a remarkably user-friendly program that performs some very sophisticated analysis. Its use of the graphical power of the Macintosh lets students concentrate on the content and procedure of finite-element analysis, which can therefore be taught much earlier in the curriculum. MacPoisson allows you to tackle two-dimensional problems governed by Poisson's equation. While very sophisticated in analytical capability, the programs' intuitive interface makes them useful the very first day of class. Both are available in two versions: a student version restricted to 300 degrees of freedom and a professional version that offers as many degrees of freedom as the available memory allows. With the Macintosh Plus, 1,000 equations can be solved using extended precision. In addition, textbooks are available from Cooke Publications to supplement the software: *MacElastic: Finite Element Analysis and Elasticity Theory with the Macintosh*, by J. R. Cooke, D. C. Davis, and E. T. Sobel; *MacPoisson: Finite Element Analysis and Poisson's Equation with the Macintosh*, by J. R. Cooke, D. C. Davis, and E. T. Sobel.

System Requirements: Any Macintosh with at least 512K of RAM and an external drive
Contact: Cooke Publications, P.O. Box 4448, Ithaca, NY 14852; 800-482-4438

MGM Station

This program offers students hands-on experience with a true CAD workstation.

MGM Station (Micro Graphic Manufacturing Station) is a complete CAD program for the Macintosh. Already used by many engineering and design firms, MGM Station offers students hands-on experience with a true CAD workstation. CAM functions are also available in additional packages.

MGM Station...

- Provides a variety of geometric tools, including lines, arcs, fillets, sections, and splines.
- Enables tangent lines and arcs to be connected between lines and circles with a simple click of the mouse.
- Allows CAM construction, including the creation of mold-line data, airfoil, or digitized points, through a special splining feature.
- Permits the user to rotate designs to any angle, and to produce mirror images.
- Offers unlimited reduction or enlargement.
- Includes dimensioning commands that allow complete flexibility of all computations, which are accurate to four digits in both English and metric equivalents.

- Supports most A- through E-size plotters. Drawings may also be printed on the Apple LaserWriter or ImageWriter printer and transferred with ease to other applications such as MacWrite, Microsoft Word, and PageMaker.
- Accepts drawings from other CAD systems, using an IGES translator.
- Features multiple layering (to 56 levels), full grouping capability, and easy-to-use libraries of symbols and drawings. Color is supported in the Macintosh II.
- Can be used to run any numerically controlled device.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: Micro CAD/CAM Inc., 5900 Sepulveda Blvd., Suite 340, Van Nuys, CA 91411; (818) 376-0008

MSC/pal

This program makes it easy to work with finite-element-analysis problems.

MSC/pal is a powerful program that allows finite-element-analysis problems to be brought to the desktop. Because of its use of the Macintosh interface, students can quickly be performing analysis and modeling, instead of spending time learning the complex interfaces often associated with finite-element-analysis programs.

System Requirements: Macintosh Plus, Macintosh SE, or Macintosh II; external drive recommended
Contact: MacNeal Schwendler Corporation, 815 Colorado Blvd., Santa Monica, CA 90041; (213) 258-9111

VersaCAD Macintosh Edition

This program brings an advanced level of professional CAD to the Macintosh.

VersaCAD Macintosh Edition brings an advanced level of professional CAD to the Macintosh—and in color on the Macintosh II. This proven and popular program has been carefully designed from the beginning to take full advantage of the Macintosh interface and graphics abilities. Thus, it offers a combination of power and ease of use that's unique in the CAD domain. Interactive drawing and editing features allow the user to see the current modifications at all times. VersaCAD Macintosh Edition uses a sophisticated object-grouping technique that allows collective editing of the drawing parts in almost any combination. Advanced symbol libraries increase productivity and facilitate design modifications and analysis. The program is compatible with PICT, VLINK, IGES, and DFX formats. On-line help is available through a HyperCard™ stack.

System Requirements: Macintosh Plus, Macintosh SE, or Macintosh II, with 1 megabyte of RAM, and two 800K disk drives or a hard disk
Contact: VersaCAD Corporation, 2124 Main Street, Huntington Beach, CA 92648; (714) 960-7720

Chemical Engineering Applications

MicroChem

This package is a powerful tool for chemistry research and chemical engineering courses.

MicroChem is a science package that is available in four units. The first unit provides capabilities for inputting, building, displaying, and performing computational analysis of organic molecules. Molecules can be built from two-dimensional sketching and Cartesian or fractional coordinate input. A robust minimizer converts two-dimensional drawings into reasonable three-dimensional structures. There is also a molecular-mechanics-based conformational analysis system. The display program can rotate bonds; measure bond and dihedral angles and bond lengths; draw stick, ball-stick, space filing, and Newman projection representations; and perform animated rotations. The second unit of MicroChem builds three-dimensional zeolitic structures by assembling three-dimensional fragments contained in a library. The third unit treats synthetic polymers. The fourth unit treats molecular properties based on the "group additivity" concept. Functions are available to search for chemical substituents whose properties are equivalent to a template substituent. Other available properties include pi, sigma, molar refractivity, and volume. MicroChem is a powerful tool for both faculty members doing research and students taking beginning through advanced chemistry and chemical engineering courses.

System Requirements: Macintosh Plus, Macintosh SE, or Macintosh II, with two 800K disk drives
Contact: Intersoft, Inc., 282 E. Woodland Road, Lake Forest, IL 60045; (312) 234-4505

Molecular Editor

This program is a three-dimensional structure tool.

Molecular Editor is a three-dimensional structure tool for the Macintosh personal computer, developed by Allen L. Smith of Drexel University, which provides an advanced way to teach atomic structure. In addition to the molecular models that students build using physical representations of atoms and bonds, Molecular Editor allows visualization of difficult concepts. For example, students can independently rescale atomic radii while leaving bond lengths unchanged, allowing continuous variation from a touching-hard-spheres model to a bonds-only model. Other options allow the measurement of the distance between two atoms, the bond, and torsional angles. Viewing angles are easily changed and up to 20 files can be open at once for rapid comparison. Sample files of organics, functional groups, inorganics, crystals, simple geometric shapes, and a three-dimensional animation of a chemical reaction are included.

System Requirements: Any Macintosh system
Contact: Molecular Editor is available through Kinko's Academic Courseware Exchange Program.

Industrial Engineering Applications

This package is a general-purpose data-acquisition system.

MACONTROL-IDAC-1000
MACONTROL is a general-purpose data-acquisition system that allows students and faculty to collect, manipulate, analyze, store, and publish information from any instrument or sensor controlled from a host computer. The IDAC-1000 is an RS-232 peripheral that functions as an interface between the Macintosh and the instruments under its control. Using the simple Macintosh interface, the user can then control and record data from these instruments. The user can specify the input channel or channels to sample and how often samples are to be taken. Users also have complete control over the output devices. All sampled data is then written as standard text files for use by any of the data-analysis programs available for the Macintosh.

System Requirements: Any Macintosh with at least 512K of RAM and two 800K disk drives
Contact: International Data Acquisition and Control, Inc., 4 Limbo Lane, P.O. Box 397, Amherst, NH 03031; (603) 673-0765

This program is a technical spreadsheet that stores data in chronological order.

Parameter Manager Plus
Parameter Manager Plus is a technical spreadsheet that stores data in chronological order. It features extensive graphics and data-analysis capabilities. Ten different analysis commands provide various ways of showing trends; forecasting future values or times; creating high-low charts, histograms, or control charts; and comparing parameters. Comprehensive technical graphing tools provide complete control over graphic data analysis, including the ability to plot more than 32,000 points. Multiple files can be sorted and organized based on user-selected attributes. Students can set limits that indicate when maximum, minimum, or referenced values are reached. Data can be imported from virtually any text format. And because integrated communications software is available that allows data entry from other computer systems, data loggers, and instruments, Parameter Manager Plus provides a complete data-acquisition and analysis solution.

System Requirements: Any Macintosh with at least 512K of RAM and two 800K disk drives
Contact: Rebus Development Corporation, 651 River Oaks Parkway, San Jose, CA 95134; (408) 263-2200

Engineering Productivity Applications

BEN-2048 BenchTop Instrument

This package is an acquisition device for general laboratory work.

A compact, isolated, and shielded acquisition device for general laboratory work, the basic unit comes complete with on-board ROM, 2K scratch RAM, Intel 8031 processor, safety power-supply serial port, and extensive user documentation. BEN-2048 can be programmed in any conventional language that will handle serial I/O programs. Transfer rates of up to 38.4Kbaud (with serial ports) or 40K per second (with SCSI option) are available. Users may download programs to the processor and run it detached from the host.

System Requirements: Any Macintosh system
Contact: Metaresearch Inc., Pacwest Center, Suite 2860, 1211 S.W. Fifth Avenue, Portland, OR 97204; (503) 228-5806

LabVIEW

This program lets you build customized instruments.

LabVIEW is a unique development environment for virtual instruments. Users can now build their own customized instruments using LabVIEW's powerful graphical programming language, which is based on block diagrams. LabVIEW uses data flow, parallel processing, and multitasking concepts to execute the block diagram exactly as it is constructed by the user.

Also available is a complete family of plug-in cards for IEEE-488, analog-to-digital and digital-to-analog conversion, digital input/output, timing input/output, high-speed DMA data transfers, and Real Time System Integration (RTSI).

System Requirements: Macintosh Plus, Macintosh SE, or Macintosh II; external drive recommended
Contact: National Instruments Corp., 12109 Technology Blvd., Austin, TX 78727-6204; 800-531-4742

MacADIOS

This is a 10-board set that connects the Macintosh II to the outside world through a number of analog and digital channels.

GW Instruments has released a new line of hardware and software to handle all aspects of data acquisition, data analysis, and external control applications on the Macintosh II. The MacADIOS II system is a 10-board set that connects the Macintosh II to the outside world through a number of analog and digital channels. This system is suited to a number of applications, including laboratory data acquisition, speech analysis, signal generation and analysis, and external process control and monitoring. An extensive line of scientific and engineering software is also available. Included are numerous "virtual instruments" (an oscilloscope, spectrum analyzer, sonogram generator, 8-channel voltmeter), a large subroutine library, and MacADIOS Manager II software for creating, testing, running, analyzing, and reporting data acquisition and control projects.

Hardware accessories are also offered. These include analog signal conditioning subsystems for data input from thermocouplers, RTDs, millivolt, volt, and process current sources. Output modules translate signals from the MacADIOS to isolated process current signals. The digital signal conditioning system sends high-level AC and DC signals to field devices and returns on/off information from external switches.

Complete MacADIOS systems cost from $1,500 to $10,000.

For more information, contact: GW Instruments, P.O. Box 2145, Cambridge, MA 02141; (617) 625-4096

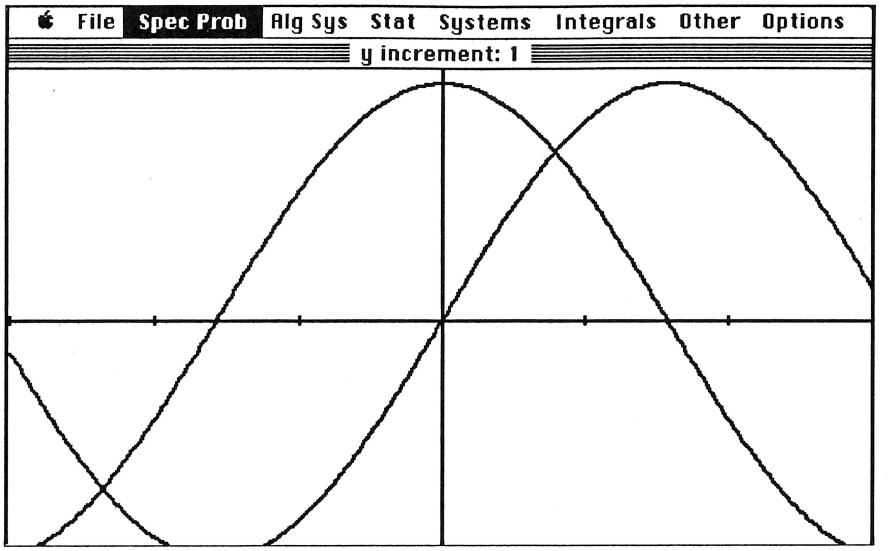
MacMathPac

This program provides a precision calculating tool for the Macintosh.

MacMathPac provides a precision calculating tool for the Macintosh. It features a wide range of utilities, including the following:

- Algebraic systems such as matrices, linear systems, and Eigenvalue problems.
- Ordinary differential equations.
- Both single-dimensional and multidimensional integrals.
- Fast Fourier transform and its inverse.
- Series operations.
- Special functions: Legendre, Bessel, Chebyshev, Laguerre, and others.
- Statistics: Linear and nonlinear least-squares fit.

MacMathPac eliminates the necessity of learning complicated input commands to work with mainframe statistics programs, by bringing the advanced, accurate scientific computational power of a mainframe to your Macintosh computer. The program uses the simple Macintosh interface and features sophisticated graphics, so even complex numerical presentations become simple and clear. Output and data sets can be stored for further analysis.



System Requirements: Any Macintosh with at least 512K of RAM
Contact: A.L.M.S., 10402 N. 10th Street, Suite 3, Phoenix, AZ 85020

MacSpin

This program offers a new way to visualize, analyze, and interact with data.

MacSpin offers a new way to visualize, analyze, and interact with data. Giving students the opportunity to quickly visualize the complicated interrelationships that can occur in many physical relationships can dramatically affect the quality of learning. For example, with MacSpin, users can see interrelationships and patterns in plots of three variables and explore the relationship of a fourth variable to the three in the display. MacSpin shows anomalies, trends, and complex structures in data instantly and visually.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: D^2 Software, 3001 N. Lamar Blvd., Suite 110, Austin, TX 78705; (512) 482-8933

MathWriter

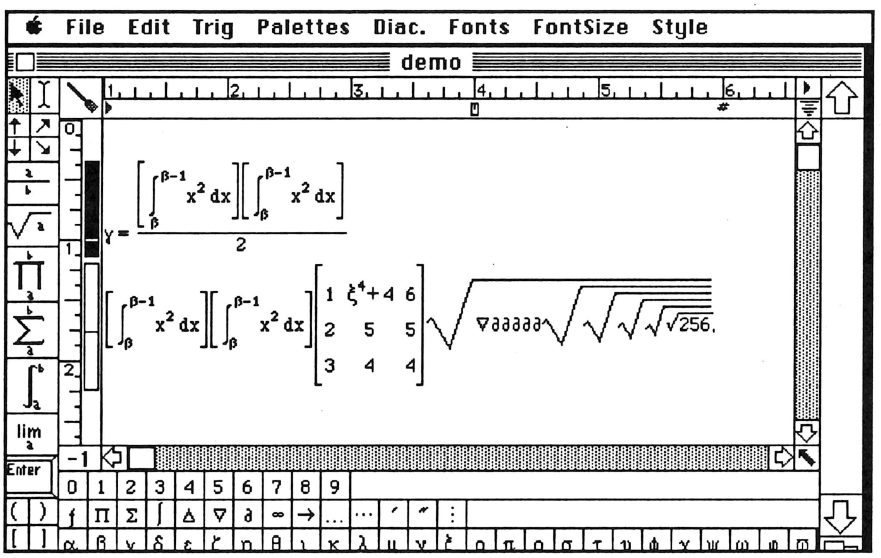
This program is a powerful DTP tool.

MathWriter is a powerful desktop publishing tool that allows users to create professional-looking scientific documents. A user-customizable palette allows simple point-and-click composition of mathematical expressions.

MathWriter automatically manages the placement and sizing of fraction bars, parentheses, brackets, braces, multiple levels of subscripts and superscripts, integral and summation symbols, and limits of integration and summation. It facilitates editing of expressions by allowing you to do the following:

- Prescribe defaults for symbol placement.
- Mix text and equations.

- Align rows and columns.
- Superimpose multiple characters.
- Stretch or shrink symbols.



Unlike some equation processors, MathWriter reduces to "point and click" simplicity the generation of very sophisticated equations. And equations produced with MathWriter can be easily placed into other Macintosh programs using the standard cut-and-paste conventions.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: Cooke Publications, P.O. Box 4448, Ithaca, NY 14852

Simul

This program lets users model a wide variety of phenomena.

Dynamic simulation is a key emerging computer technology. With simulation software, phenomena in a wide range of fields can be modeled and predicted, multiple theories can be tested, and appropriate actions taken. Now, with a product called Simul, dynamic simulation software is available on the Macintosh.

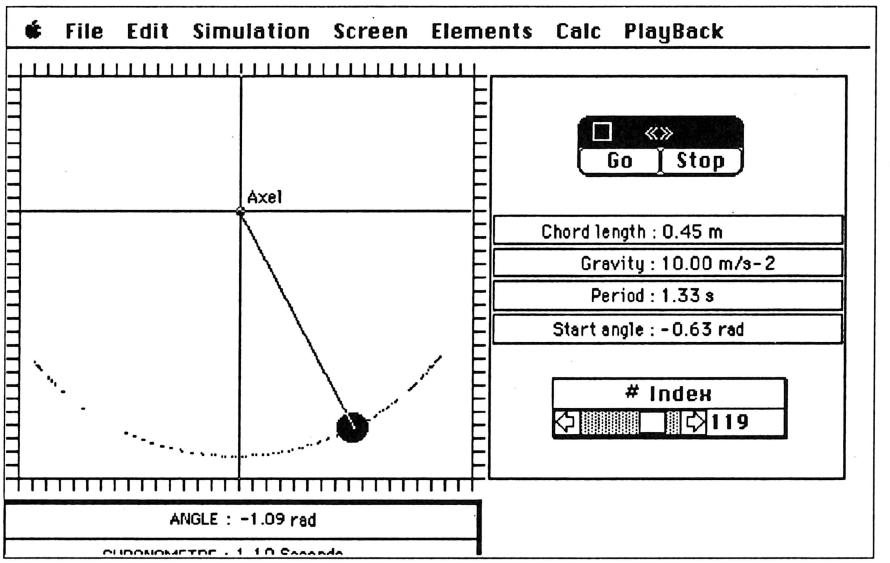
Simul...

- Provides a complete set of functions and elements for building models of virtually all physical phenomena that are based on a succession of changing states.
- Displays the simulation graphically screen-by-screen—calculating at 3,000 screens per second—once a phenomenon is modeled.

- Displays numerically the position of each element in each screen in a table that's compatible with other spreadsheet programs.

- Reacts immediately to changes in any parameter of the simulation, incorporating them into the simulation and showing their effects.

Just as the spreadsheet allowed us to ask "What if?" questions involving financial calculations, this new class of software allows the "What if?" approach to be applied dynamically to questions of physics, chemistry, electronics, economics, and engineering. Simulations can be of any phenomenon that the user can model in mathematical terms; they might be as simple as a bouncing ball or a swinging pendulum or as complex as engine analyses or trajectory plotting.



Simul's place is in the classroom, in the research lab, and in business.

- In the classroom, Simul can make mathematical concepts "come alive." Teachers can use Simul to build models for their students to study and modify.

- In research laboratories today, several scientists often must share a minicomputer, which can result in work slowdowns. With Simul and the Macintosh, each researcher can have his or her own computer on which to run simulations.

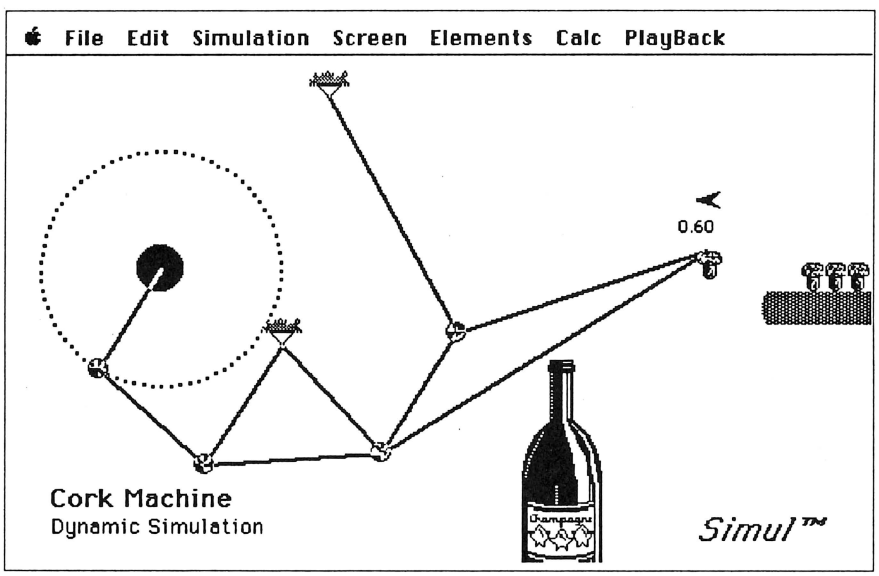
- Engineers and researchers in business can use Simul to test their system designs quickly and efficiently and to prepare proposals for more extensive research projects.

Simul contains all of the necessary tools to build complete simulation models.

- A model is composed of a group of elements moving across a series of screens, called indices. The user can place up to 32,000 indices in one simulation. The elements are drawn directly with Simul or pasted in from the Macintosh Clipboard.

- Movement is assigned to individual elements or structures of elements graphically, by assigning to them coordinates for each index, or by formula. Whole simulations can be created by pasting data from a spreadsheet (or any source) onto graphic elements, creating dynamic bar charts and diagrams. Conversely, the data generated by formulas can be output directly or exported to a spreadsheet program.

- Once a model is constructed, any part of it can be modified quickly, and the simulation can be rerun.



Simul expands learning opportunities by allowing studies of complex phenomena that haven't previously been accessible, safe, cost-effective, or timely. It amplifies the theoretical by means of simulated trials. And it offers a change in perspective, by moving beyond knowing "what" to learning "how" and "why."

System Requirements: Macintosh Plus, Macintosh SE, or Macintosh II
Contact: Abvent, Inc., 9903 Santa Monica Blvd., Suite 268, Beverly Hills, CA 90212; (213) 659-5157

StatView II: Statistical Analysis with Mainframe Power

This program combines comprehensive graphics capabilities with the capabilities of a powerful statistics program.

StatView II for the Macintosh II was designed specifically for the Apple Macintosh II personal computer. It combines comprehensive drawing and graphing capabilities with the capabilities of a powerful statistics program, to let you produce stunning, full-color graphs. It has also been designed to take full advantage of the numeric coprocessor in the Macintosh II. This enables StatView to perform analyses up to 50 times faster than previously possible.

The last issue of *Wheels for the Mind* described some of the features of this statistics package, but it did not provide a listing of the different statistical routines that were available with it.

The statistical analyses that are available include: mean, standard deviation, standard error, variance; coefficient of variation, median, mode, percentiles; confidence intervals, kurtosis, skewness; frequency distributions (up to 100 intervals); comparison percentiles; one- and two-sample paired/unpaired t-tests; pairwise/listwise correlation coefficient; 1- through 16-way ANOVA; factorial and repeated measures models; unbalanced and missing cell designs; simple, multiple, and polynomial regressions; Beta, T, and confidence intervals; stepwise regression with user-specified F; cross-tabulation tables (up to 1,600 cells); multivariate factor analysis (extensive) nonparametric tests: Wilcoxian signed rank, Wald-Wolfowitz runs, Mann-Whitney U, Kolmogorov-Smirnov, Kendall rank, Spearman rank order, Kruskall-Wallis, and Friedman; 35 data transformations; normal random numbers; sorting; and text importing and exporting.

If you add a third-party accelerator board (with 68020 and 68881 processors) to your Macintosh SE, you can then use StatView II on your SE.

For more information, contact: Abacus Concepts, Inc., P.O. Box 3086, Berkeley, CA 94703; (415) 540-1949

STELLA: Simulation Software for Everyone

This program is an easy-to-use simulation tool.

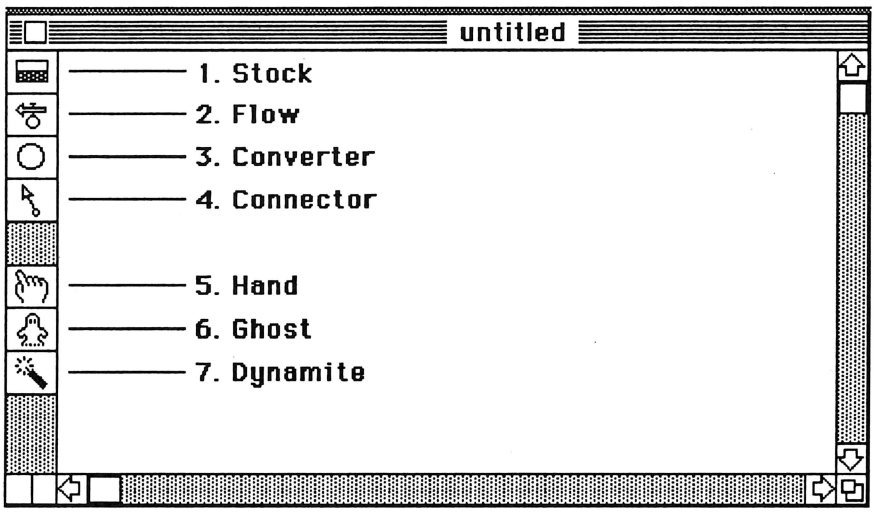
The advent of personal computers has greatly increased the potential for faculty and students to gain a deeper understanding of dynamic phenomena. With personal computers, students and faculty have available the power needed to create *simulation laboratories*. These laboratories can be used to explore a wide variety of dynamic processes in both the natural and the social sciences. To date, however, few software packages have unleashed the power of the personal computer in a form that is accessible to virtually any student or faculty member. Creating a computer-based simulation laboratory typically requires expertise in BASIC, Pascal, or some other programming language, and many of those who could benefit from the use of simulation simply do not have the required expertise in programming.

STELLA for Academe is a product that removes much of the burden associated with the creation of high-quality computer-based simulation laboratories, enabling virtually anyone in the academic community to increase their understanding of dynamic phenomena.

Basic Building Blocks

With STELLA, you will use four basic building blocks to map the logic of the dynamic process or system that you want to understand. These building blocks, and the tools that are used to manipulate them, are shown in Figure 1.

Figure 1



The Stock: The Stock is the generic symbol that STELLA uses to represent anything that accumulates. For example, widgets accumulate in a producer's inventory. At any point in time, the number of widgets in the inventory reflects the *accumulation* of what has been produced, minus what has been sold. Other examples: money accumulates in bank accounts; knowledge accumulates in your brain; water accumulates in a bathtub; products of a chemical reaction accumulate in a reaction vessel; and a population of predators accumulates in an ecosystem. Using STELLA, each of these accumulations would be depicted as a Stock.

The Flow: Flows consist of a hollow, directed pipe, with a "flow-regulator assembly" attached. Flows either augment or deplete accumulations. The flow-regulator assembly houses the logic that controls the magnitude of the flow volume. For example, the rate of widget production would be depicted as a Flow. Other examples include saving, learning, water flow, the rate of a chemical reaction, births, and deaths.

The Converter: The Converter is used to convert inputs into outputs. Typically, Converters are intermediate links in a chain of cause and effect. Converters, like Stocks, exist at a point in time. Unlike Stocks, Converters do not accumulate Flows.

Connectors: Connectors are used to link Stocks with Flows and Converters, or Converters with other Converters and Flows. Converters depict the hypothesized causal linkages within a STELLA model. They thus reflect assumptions about "what depends upon what" in the structure of a model.

How STELLA Works—Compound Growth in a Savings Account

To illustrate how STELLA works, consider the simple phenomenon of compound growth in a savings account. Using STELLA, model construction and analysis would consist of three major activities: creating a "map," defining relationships, and simulating.

Creating a Map: Figure 2 shows a STELLA map of the process. The Stock is used to represent savings. It is simply the amount that an individual has in his or her savings account, at any point in time. The Flow—an *inflow* to savings—is called interest income. It is the rate at which interest income accrues to the individual's savings account. Interest rate is depicted as a Converter. The Connectors state that interest income depends upon both savings and interest rate. Note the question marks in the diagram. These indicate where the user needs to specify logic or add numerical values to the model.

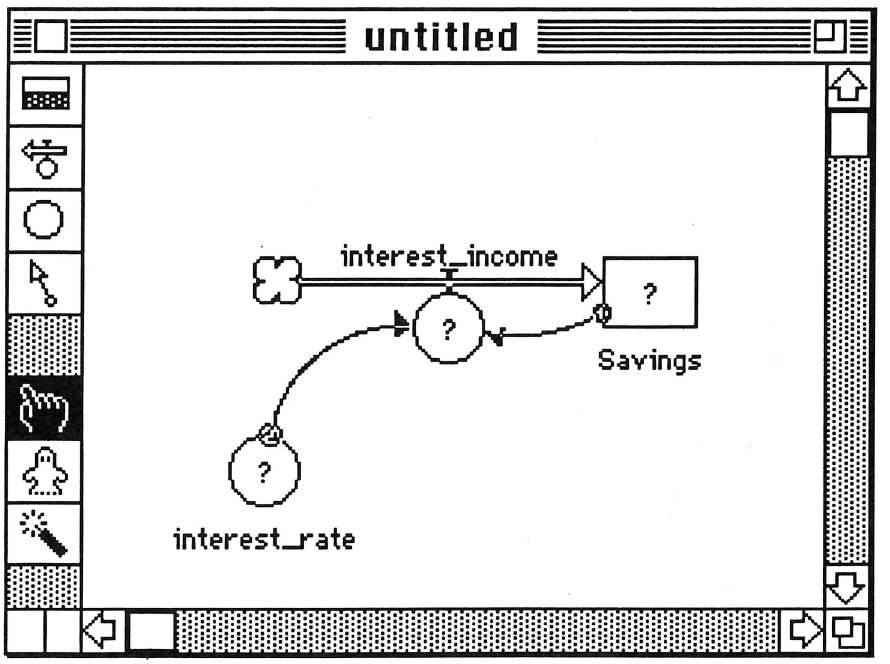
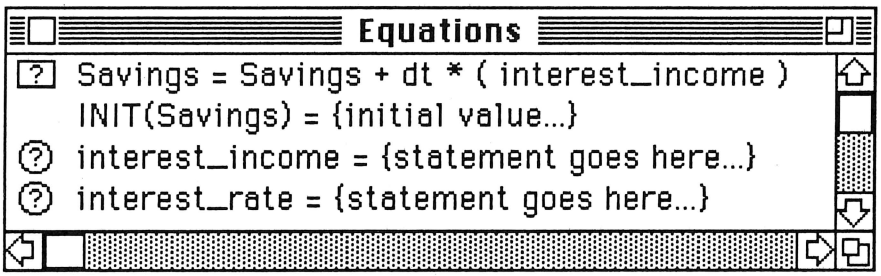


Figure 2

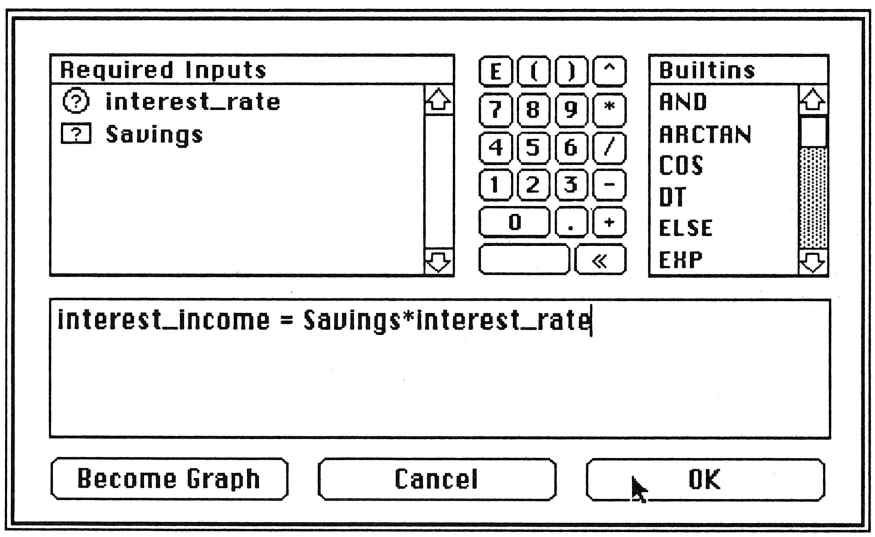
As the user creates the map, STELLA works behind the scenes to generate *automatically* the equation structure necessary to simulate the process. The equations that correspond to the map in Figure 2 are shown in Figure 3. The equation for Savings in Figure 3 should be read as: "Savings right now is equal to what it was one instant ago, plus whatever interest income has flowed in over that instant." The remaining equations in Figure 3 indicate that the initial amount of savings, the logic determining interest income, and the value of interest rate are yet to be specified.

Figure 3



Defining Relationships: Once the user has created a map of the system, it is easy to define the remaining logic. For example, interest income is simply the product of savings and interest rate. This equation can be "clicked in," as shown in Figure 4. Note that STELLA enforces a one-to-one correspondence between the diagram and the equations that are used to run the simulation—both savings and interest income are shown as "required inputs" to the equation. Note also the host of built-in functions, to the right of the figure, that can be used as macros.

Figure 4



The initial value of savings, and the value of interest rate, are defined in an analogous manner. As Figure 5 shows, savings begins at $1,000. Interest rate is a constant 10 percent per year.

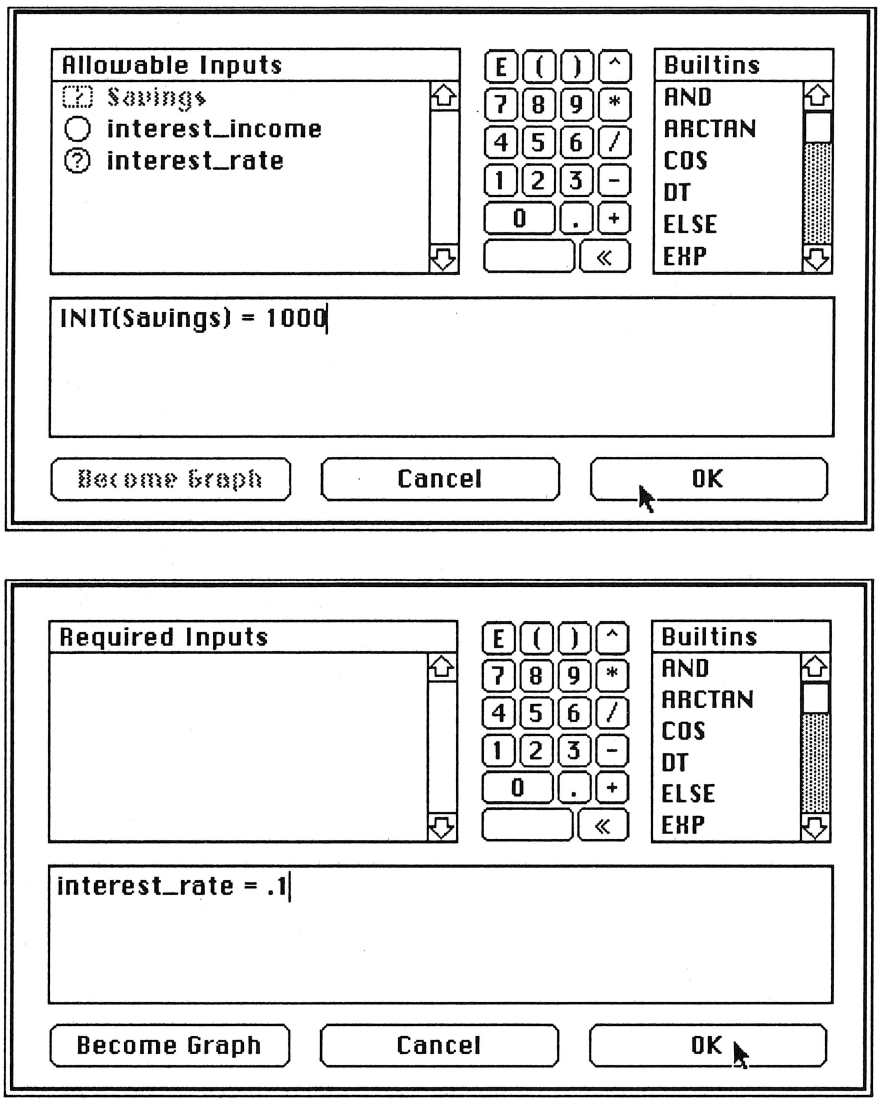
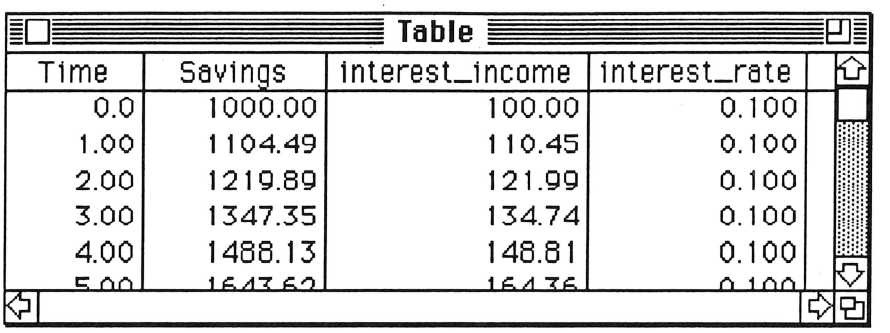


Figure 5

Simulating: Once all relationships are defined, STELLA allows you to bring the map to life via simulation. You can view dynamic behavior as (1) an animation of the diagram—Stocks fill and drain as Flows wax and wane; (2) time series or scatter plots; and (3) tables of numeric values. These different viewing options are shown in Figure 6. As is shown, this simple model generates compound growth. If it didn't, we would be obligated to use STELLA to revise our assumptions about the process.

Figure 6



Table

Time	Savings	interest_income	interest_rate
0.0	1000.00	100.00	0.100
1.00	1104.49	110.45	0.100
2.00	1219.89	121.99	0.100
3.00	1347.35	134.74	0.100
4.00	1488.13	148.81	0.100
5.00	1643.62	164.36	0.100

STELLA thus helps the user make the connection between *structure* (assumptions about a process is put together) and *behavior* (how the assumptions interact with one another over time). Note that this simple model has been developed at a very visual level. With STELLA, you need not resort to differential equations—or to FORTRAN code—to create a high-quality simulation laboratory.

Documentation

STELLA for Academe is supported by an extensive (~400-page) user's guide, written expressly for the academic community. This guide provides both the conceptual background and the technical information needed for effective use of the software. Throughout the guide, examples and illustrations are culled from a variety of disciplines in the natural sciences, social sciences, and humanities.

Over one-fourth of the guide is devoted to substantive applications. These applications come from the quantitative sciences, the qualitative sciences, and the strategic and operational sides of administration. The applications thus are representative of the wide range of uses for STELLA in an academic environment.

STELLA for Academe is available only to academic institutions, their faculties, students, and staff.

For more information, contact: Steve Peterson, Director of Academic Products, High Performance Systems, 13 Dartmouth College Highway, Lyme, NH 03768; (603) 795-4857

VersaTerm-PRO

VersaTerm-PRO is a text and graphics communications program and terminal emulator that gives users of a wide variety of computers access to the graphics and editing ease of interface of the Macintosh personal computer. Terminal emulation supported includes Tektronix 4105, DEC VT100, and Data General D200 emulations. VersaTerm-PRO provides file transfer, access to remote databases, and mainframe communications, emulating both text and graphics terminals.

This is a text and graphics communications program and terminal emulator.

System Requirements: Any Macintosh with at least 512K of RAM
Contact: Peripherals Computers and Supplies, Inc., 2457 Perkiomen Avenue, Mount Penn, PA 19606; (215) 779-0522

Nonengineering Products

Programmer's Workshop Modula-2

TML Modula-2 is an implementation of the Modula-2 programming language for the Macintosh, using Macintosh Programmer's Workshop (MPW) environment. TML Modula-2 is capable of creating stand-alone Macintosh applications, MPW tools, simple I/O programs, and desk accessories. This product is a complete implementation of the Modula-2 language as defined in *Programming Modula-2,* the third corrected edition, by N. Wirth. System requirements include either a Macintosh Plus, Macintosh SE, or Macintosh II, with either two floppy-disk drives or a hard disk. The Macintosh Programmer's Workshop is also required and is available from the Apple Programmer's and Developer's Association at 290 SW 43rd Street, Renton, WA 98055; (206) 251-6548.

This is an implementation of the Modula-2 language using the MPW environment.

For more information about TML Modula-2, contact: TML Systems, 4241 Baymeadows Road, Suite 23, Jacksonville, FL 32217; (904) 636-8592

Mac-streamer: Macintosh 9-Track Tape

This product is a reliable means of transporting data between the Macintosh and minicomputers or mainframes.

Mac-streamer is a 9-track, 1/2-inch tape drive with SCSI controller and special software that provides Macintosh users with a fast, reliable means of transporting data between the Macintosh and minicomputers or mainframes. It also provides for high-speed backup. Conversion of Macintosh data to IBM or ANSI format is simple and fast. The high-performance tape drive handles both 1600 and 3200 bpi. Features include EBCDIC-to-ASCII translation, disk backup, fixed or variable length records, and blocking/unblocking of data. Mac-streamer is priced at $3,995.

For more information, contact: Qualstar, 9621 Irondale Avenue, Chatsworth, CA 91311; (818) 882-5822

MSF-300G: Gray-Level Desktop Scanner

This product is a low-cost gray-level desktop scanner.

The MSF-300G, from Microtek Systems, is the first low-cost gray-level desktop scanner. It allows the user to scan up to 8 bits per pixel of gray-level data. With this much data available, high-resolution output devices such as the Linotronic L300 and L100 will be able to print images utilizing their full capabilities. A second important function of this machine is the ability to provide the multi-bit-per-pixel data needed to perform sophisticated "post-processing." With 6 to 8 bits of information available, powerful new-generation graphics editing software can draw shades of gray; use exciting new tools such as "charcoal," "water drop," and "finger painting"; modify brightness and image contrast; and provide true sizing and image rotation without image degradation. Price is expected to be in the $3,000 to $4,000 range.

In addition, MacOCR is available for use with the scanner. It can read more than 250 different typefaces; read characters from 6 to 12 points in size; read mono, proportional, foreign-accent characters; and some typeset faces. As the text is recognized, it is converted into MacWrite, Microsoft Word, or plain ASCII text format for editing or movement into other word processing software. It is priced at $895.

For more information, contact: Microtek Lab, Inc., 16901 S. Western Ave., Gardena, CA 90247; (213) 321-2121

HyperDrive FI/40: New HyperDrive for Macintosh II

This product is a high-performance internal 40-megabyte drive.

The HyperDrive FI/40 is a high-performance internal 40-megabyte drive available for the Macintosh II. It mounts in the disk-drive slot of the Macintosh II and connects to the internal power and SCSI connections. The drive comes with an automatic head-parking feature. The average access time of the disk is 40 milliseconds. This drive provides optimal performance in multitasking and file-server applications such as AppleShare, because it utilizes an asynchronous software driver that allows for concurrent operation of background processes during disk reads and writes.

For more information, contact: General Computer Corp., 215 First Street, Cambridge, MA 02142; (617) 492-5500

MacScheme+Toolsmith: Software-Development Tools

This is a complete software-development system, featuring the Scheme programming language.

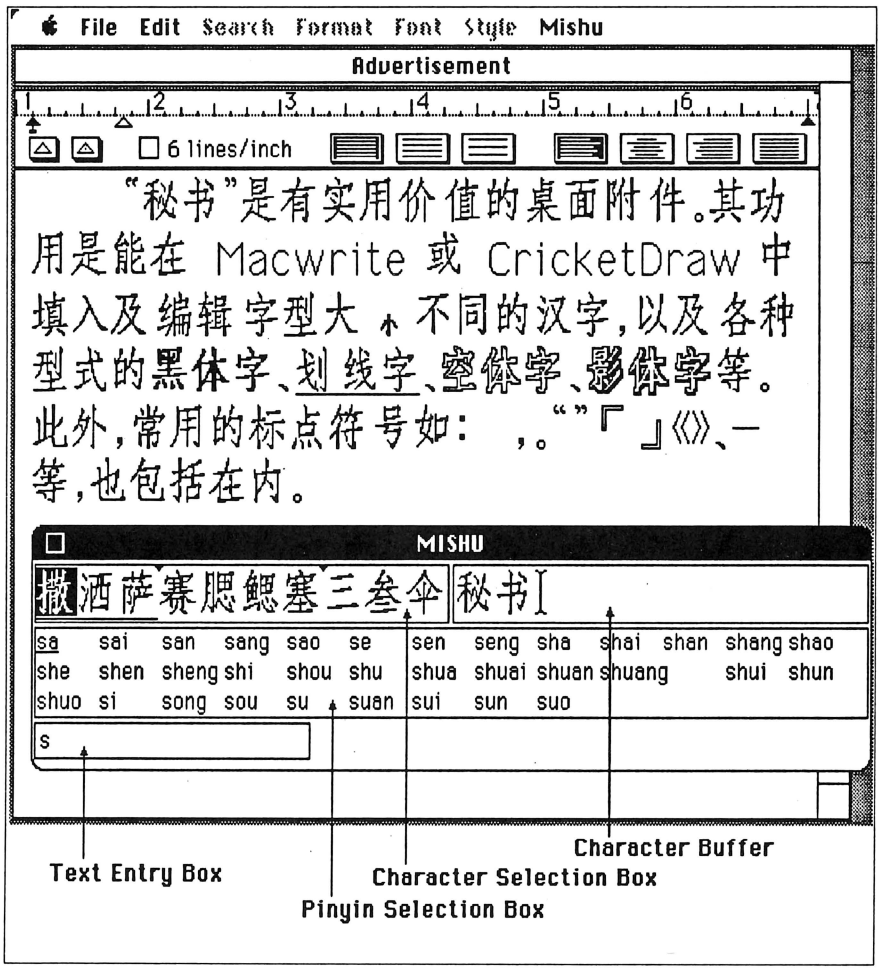
MacScheme+Toolsmith is a complete software-development system for Macintosh computers including the Macintosh II. This product features the Scheme programming language, which is an important modern dialect of LISP. An optimizing native-code compiler is included. Features include multitasking, an interrupt-driven event system, and an improved version of code. Development tools such as a source-code debugger, tracer, and integrated editor are also part of the system. The product is priced at $395 and will run on the Macintosh Plus, SE, and II.

For additional information, contact: Semantic Microsystems, 4470 SW Hall Street, Suite 340, Beaverton, OR 97005; (503) 643-4539

MISHU: A Chinese Characters Desk Accessory

This desk accessory lets you enter Chinese characters into a MacWrite or Cricket Draw document.

MISHU is a desk accessory that enables one to enter Chinese characters into a MacWrite or Cricket Draw document. It can be used to compose short notes and letters, create posters, do annotations, and so on. To use MISHU, you need a Macintosh with at least 512K of RAM and at least two 400K drives; MacWrite and the Suzhou fonts will take up 350K of space on one disk. MISHU can be installed into the System file on the other disk. The System/Finder must be Version 3.2/5.3 or later. Even though it is possible to do some Chinese word processing with MISHU, it's not recommended for heavy-duty work, because it is limited by the character-based input method. It also has a problem with the LaserWriter printer, which cannot download more than a handful of bit-mapped fonts; MISHU uses 20.



The Pinyin-based input method is very easy to learn and use. When MISHU is activated from the Apple menu, it superimposes an interface window over the MacWrite document. The user types into the Text Entry box, and MISHU instantly displays a row of 10 Chinese homonyms and all the downstream Pinyin possibilities. (Entries that are not spelled correctly are automatically erased with a beep.) The user then has a choice of typing further to narrow the selection, scrolling to view other homonyms (if any), or selecting one of the ideograms to be moved into the Character Buffer. When this buffer fills, MISHU automatically pastes the characters in it into MacWrite and the MISHU window returns for further entry. The program has a total of 3,755 24-point simplified characters in the "fang-sung" style.

Pricing Information:
Regular price: $89
Student price: $59 (Please include a copy of your student ID.)
Demo disk: $5

For more information, contact: Xanatech, Inc., 20 Fresh Pond Place, Cambridge, MA 02138; (617) 492-7463

Desktop Enhancements

This product lets you create your own personalized icons.

Icon-It! allows users to create their own personalized icons to represent frequently used menu functions, desk accessories, function keys, and macros, and display these icons on an "icon bar" appearing anywhere on the screen. For example, instead of having to pull down the Edit menu and find the Cut option, the user could just click on a scissors icon to cut selected text. Icon bars for over 40 popular third-party programs are included. Suggested price is $79.95.

Icon-It! 1.01 is a free update that became available in January 1988. It will add MultiFinder™ compatibility, by automatically switching icon bars as users move to other applications.

Icon-It! Runtime allows developers to add a custom icon bar to their own applications.

DA-Switcher II allows the user to access an unlimited number of desk accessories. The suggested price is $49.95.

Site licensing for these products is available.

For more information, contact: Olduvai Software, Inc., 7520 Red Road, Suite A, South Miami, FL 33143; (305) 665-4665

Grant Management Software

This product helps you handle grant accounting.

Grant Manager is a general-purpose grant/fund accounting program for the Macintosh. Using the order-entry module, orders are typed into the computer. The program prints on requisition/order forms and maintains customized vendor catalogs. Charges to grants are tracked automatically. Printed reports aid in the analysis of ordering and spending activities. The reconciling module keeps accounts balanced with university ledgers.

A second program, Personnel Manager, is a module designed as a stand-alone tool or as a companion to Grant Manager. It allows easy projection of personnel costs, distributes salaries among grants, forecasts ending grant balances, and posts personnel transactions to Grant Manager. A unique feature is its ability to switch instantly from a screen showing a person's salary distribution to a screen showing cost projections for a grant. Each program costs $425.

For more information, contact: Niles & Associates, 2200 Powell, Suite 765-B, Emeryville, CA 94608; (415) 655-6666

HMSL: Hierarchical Music Specification Language

This product allows advanced experimentation in composition, cognition, perception, performance, and electronic music.

HMSL is a music composition and performance programming language that offers the user an environment for advanced experimentation in composition, cognition, perception, performance, and electronic music. It is an object-oriented set of extensions to the Forth language that runs on Macintosh and Amiga computers. HMSL is fully extensible and customizable by the user. Full source code is provided.

HMSL includes utilities and tools for some of the following areas of musical research:

- Algorithmic composition and musical artificial intelligence.
- Designing real-time intelligent instruments.
- Generating hierarchies of programmable music objects that can be modified during execution.
- Controlling and responding to MIDI devices.
- Treating musical parameters as abstract numeric data that can be edited graphically or programmatically.

- A full object-oriented programming environment (ODE).

HMSL has three main modules: a graphics editor (CREATE), a real-time stimulus response environment (PERFORM), and a complex hierarchical scheduler (EXEC). All of these modules interact, and can affect each other's behavior.

HMSL provides a number of predefined classes of musical objects. These music objects, or morphs, can be arranged in a complex hierarchy and performed by a Polymorphous Executive. For example, a shape contains a set of points in a multidimensional space. Shapes are considered to be raw numeric data and can be edited graphically, or through programming while they are being played. The raw data of the shape can be arbitrarily assigned to musical parameters by a customizable interpreter. Thus, a shape can describe anything from a melody to a profile of harmonic complexity. Special methods for manipulating shape data include inversion, transposition, randomization, and reversal. Users can also easily design their own methods.

HMSL provides a sophisticated and customizable set of tools for control of MIDI devices and other music hardware. A complete MIDI toolbox is provided for low-level control. Virtual instruments can be used to isolate high-level compositional processes from the specifics of the particular hardware being used.

Many simple examples and small pieces are included to help people get started. The manual is quite extensive and includes a series of tutorials. Telephone assistance is provided for licensed users, as well as a newsletter. We also maintain an electronic network of HMSL users for the purpose of sharing HMSL code, pieces, experiments, comments, and suggestions.

For more information, contact: Larry Polansky, Mills College, 5000 MacArthur Blvd., Oakland, CA 94613; (415) 430-2336

Torts Exercises

This is a series of tutorials to develop legal reasoning.

The Franklin Pierce Law Center has created an application called Torts Exercises, a series of 13 tutorials that develop legal reasoning. Each tutorial should take a student from half to three-quarters of an hour to complete. The tutorials place the student in the role of a lawyer who is evaluating a client's case. The cases progress from a simple accident situation in which the student uses straightforward "common sense" to evaluate the case, to more complex cases requiring more sophisticated legal reasoning. All of the major areas of tort law (negligence, product liability, defamation, economic harm, privacy, intentional torts, trespass, and nuisance) are represented in the cases. The aim of the tutorials is to teach

legal analysis, the process of evaluating facts and making value judgments. These applications can be obtained from Kinko's Service Corporation, 4141 State Street, Santa Barbara, CA 93110; 800-235-6919; in California, 800-292-6640

Desktop Publishing Information

A database that provides an in-depth, annotated bibliography of DTP-related articles.

MacDTP is a Microsoft File database that provides an in-depth, annotated bibliography of all business, trade, and educational articles on Apple Desktop Publishing, complete to the end of 1986. Version 1.0a contains 1,163 articles treating desktop publishing and related topics, with full annotations averaging three sentences in length. MacDTP can be searched for references by product, application, or name. Data may be sorted by author, title, periodical, date, or a combination. Comes with 50-page documentation.

For more information, contact: Steven Dayo, University of Minnesota, Department of Journalism, P.O. Box 11626, St. Paul, MN 55111

Using SuperPaint in Conjunction with Professional Composer

Mark of the Unicorn has wisely provided its Professional Composer with the ability to convert letter-sized manuscript pages into files that can be opened and subsequently edited with graphics programs such as MacPaint and SuperPaint. The following discussion presents a few of SuperPaint's advantages, as well as several pointers regarding its use in conjunction with Professional Composer.

Unlike MacPaint, SuperPaint is equipped with an arc tool, making it possible to create slurs and ties of any size and shape. Also, SuperPaint provides for the construction of documents on two superimposed layers, one designated Draw and the other Paint. This allows the staves of converted Professional Composer manuscripts to be backed up (traced) on the Draw layer, thereby eliminating the need to replace staff lines disturbed when a symbol is erased from the Paint layer. An entire page of backup staves can be saved as a separate file and pasted into the Draw layer of subsequent manuscript pages having the same staff layout.

Another of SuperPaint's advantages over MacPaint is its ability to produce a much smoother LaserWriter printout. Because

MacPaint images are bit-mapped with a resolution of roughly 72 dots per inch, they fall far short of the LaserWriter printer's 300-dpi capability. This situation can be improved somewhat by using the Smoothing option in the Page Setup dialog box. However, curved or slanted symbols (for example, slurs, ties, dynamic wedges, and text) will nonetheless look especially coarse when printed on the LaserWriter.

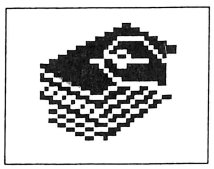
The following procedure takes advantage of SuperPaint's high-resolution, object-oriented imaging capability: While working on a Professional Composer manuscript that is intended to be converted into a MacPaint file, do not add slurs, ties, dynamic wedges, text, and other symbols likely to print poorly as bit-mapped images. Instead, convert the displayed Professional Composer page into a MacPaint file, open it with SuperPaint, and create the missing notations on SuperPaint's object-oriented Draw layer. The LaserWriter can then be expected to produce excellent results.

The time required to edit Professional Composer files with SuperPaint can be greatly reduced by transferring a copy of Professional Composer's screen-size fonts to the System file of SuperPaint's startup disk. The user is thereby provided with easy access to musical symbols from the Fonts menu. The music fonts' key/symbol correspondence can be determined by simply typing each of the available keys and key combinations, and printing out a directory of the results. If you want, you can create a personal index arranging the symbols into a logical order showing each one's corresponding key or key combination.

It is hoped that the above discussion of SuperPaint's advantages and its use in conjunction with Professional Composer will improve the reader's ability to produce a camera-ready computer manuscript. It is certainly true that these two programs provide the musician with a powerful duo of graphics applications. Nevertheless, a single Macintosh program combining the strengths of both would be much preferred!

For more information, contact: Cindy McTee, Ph.D., School of Music, North Texas State University, P.O. Box 13887, Denton, TX 76203-3887

HyperCard



This issue marks the debut of a new section in *Wheels for the Mind*: the **HyperCard** section. Because of the high degree of interest and activity concerning this product on many university campuses, it seems only fitting to dedicate some space to helping the university community stay abreast of developments. The format may change a little as we discover what kinds of materials are out there, but this issue's HyperCard section consists of three parts: articles on interesting academic HyperCard applications, Tips and Techniques, and Stackware™. If you have any insight into the workings of HyperCard, or have written a stack that you consider to be of interest to others in the university community, please send us your information. With your help, this section can become a tremendous resource.

If you have written a stack that you consider to be of interest to others, send us your information.

But first, a little background....

HyperCard—the culmination of a three-year team effort led by Bill Atkinson, Apple Fellow and the developer of QuickDraw and MacPaint—is software considered by Apple to be a fundamental building block of Macintosh technology. It is not an application like a spreadsheet or database program; it is a means by which information can be tailored to users' individual needs.

HyperCard is a personal toolkit that gives users the power to organize, customize, and access information in such varied forms as text, graphics, video, music, voice, and animation. In addition, it offers an easy-to-use English-based scripting language (HyperTalk™) that gives users an opportunity to write their own programs. HyperCard is based on a simple idea: *cards*, which are the basic units of information, are organized into *stacks*. The number of cards is limited only by the storage capacity of the user's disk. Users can browse through, sort, or make notes, type, or draw on these cards.

HyperCard gives users the power to organize, customize, and access information in varied forms.

Stackware is the name given the category of applications that users are developing with HyperCard technology. With HyperCard, you can create your own stacks or utilize stacks that have already been created. The quality of the stacks depends more on an author's ability to create content than on the author's proficiency with computer code. In higher education for example, HyperCard can turn scholars in most subject areas into courseware developers. Professors can create or purchase Stackware on a variety of subjects and integrate it into the curriculum, taking advantage of the program's customizing capabilities to fit their individual ways of interpreting and delivering the information. Similarly, HyperCard allows professors and teachers to easily integrate interactive multimedia presentations into their lessons.

We are already seeing the results of some exciting Stackware development from various college campuses. Some examples are covered in this section. With your help, we will continue to update you on HyperCard developments. We hope that you find this section stimulating and informative. With your ideas and the HyperCard personal toolkit, there's no telling how far you can go!

HyperCard Applications

The Electric Cadaver: Stanford Video Book Atlas of Human Anatomy

This stack provides a dynamic textbook on gross and microscopic anatomy.

Over the past two years, the Medical Media Project in the Division of Human Anatomy, Stanford University of Medicine, has been developing a dynamic textbook on gross and microscopic anatomy. The Electric Cadaver extensively cross-references a videodisc database of anatomical, histological, pathological, and clinical images with text, bit-mapped graphics, and animations. It features the Bassett Collection of human anatomical images, perhaps the finest collection of its kind. When completed, it will constitute an integrated interactive presentation of human structure and function.

Because of the object-oriented nature of anatomy, The Electric Cadaver has also served as an excellent support structure for the development of hypermedia editorial tools and techniques. (Some of the results of this work are presented in "An Introduction to CrossMedia Writing," a videotape available from the division.)

The Electric Cadaver has recently been ported to the Macintosh under HyperCard.

For more information, contact:
Robert A. Chase, M.D.
Chairman, Division of Anatomy
HRP Building
Stanford University of Medicine
Stanford, CA 94305
(415) 723-2404
or
Stephen Freedman, M.D.
CrossMedia Associates
583 Salva Tierra St.
Palo Alto, CA 94305
(415) 322-4024

Timetable of History: An Interactive Encyclopedia

This stack is part of a proposed "interactive encyclopedia."

Computing and Broadcasting is the first generation of an ambitious project called Timetable of History, an interactive encyclopedia that includes information on everything from religion to art to computers.

Comprising a stack of 700 cards, this initial version incorporates bibliographies, graphics, and short descriptions of 600 major events in the history of computing and broadcasting. The relatively narrow scope of this project will be expanded in the next Timetable of History product, which will be the introduction of a complete timetable of science and innovation on CD-ROM in March.

For further information, contact:
Peter Black
c/o Xiphias
13464 Washington Blvd.
Marina del Rey, CA 90292
(213) 821-0074

HyperCard Tips and Techniques

Reusing the Browse Tool. When you are designing HyperCard applications, you often have to return to using the Browse tool. The quickest way to do this is to hold down ⌘ and press Tab.

Tool Swapping. If you want to switch between the Browse tool, the Button tool, or the Field tool, then add the following script to your Home stack. It will allow you to use the Enter key to switch tools.

```
on EnterKey
    if the tool is "browse tool" then choose button tool else if the tool is
    "button tool" then choose field tool else choose browse tool
end enterKey
```

Button Hints. Sometimes it is helpful to users of your stack if they can "see" where buttons might be located. One way that this can be done is to have the user hold down Option and press ⌘. As long as those two keys are held down, all buttons that are on the current screen will be visible.

Background Buttons. When you identify button locations by holding down Option and pressing ⌘, the buttons with the thicker borders are background buttons.

Miniature Cards. If you would like to create a miniature version of a card in your stack, go to the Edit menu and choose Copy Card. Go to the card where you would like to paste the miniature version. To paste the miniature, hold down ⌘-Shift and press the letter V.

Quick Script Access. To get directly to a button's script, choose the Button tool, hold down the Shift key, and Double-Click on the button you are interested in.

Quick Help. Holding down ⌘ and pressing ? will get you to the Help stack immediately. When you exit Help (by pressing on the exit tab) you will return to the card from which you sought help.

Cursor Changes. The cursor can be set to different symbols by using the following script:

For the I-beam symbol	set cursor to 1
For the crosshair symbol	set cursor to 2
For a thick crosshair	set cursor to 3
For the watch	set cursor to 4
For the arrow	set cursor to 5

Hiding the Menu Bar. If you want to hide (or display) the menu bar, hold down ⌘ and press the space bar.

Viewing Paintings. If you are in the painting mode, you can see what is painted in opaque by holding down Option and pressing O (the letter, not the number).

Script Stopping. You can interrupt any script and stop it from processing by holding down ⌘ and typing a period.

Returning Home. If you launch a Macintosh application from a card in a HyperCard stack, you will return to that card when you quit the application that was launched. If you wish to return to the Home card instead, place the following script into your Home stack script.

```
on resume
    go home
end resume
```

Picture Taking. If you want to copy a picture from one card in a stack to another, you can use the following script.

```
on mouseUp
    choose select tool
    doMenu "Select All"
    doMenu "Copy Picture"
    go to next card
    doMenu "Paste Picture"
end mouseUp
```

Sticky Buttons. If you place a real button on top of some text that is in a scrolling text field, the button will not be properly located when the data in the text field scrolls. What is needed is a way to make the button "stick" to the word of text that has been selected. One solution is provided below. It is the script that is associated with the field that will contain the text that you want to have react to the user's selection. Note that the Button tool is not used.

```
on mouseDown
    set locktext of me to false
    click at the clickloc
    click at the clickloc
    if the selection is "whatever you want" then "do what you want"
    set locktext of me to true
end mouseDown
```

HyperCard Millionaire. If you are in a state that has a lottery, let HyperCard pick your number. The script below will pick six unique numbers between 1 and 36. You can easily change the script to reflect the conditions in your own lottery. The card you design should have a separate field for each number to be displayed and a button that, when pressed, selects the numbers. The script for that button would be:

```
on mouseUp
    put 0 into count
    repeat until count=6
        put random(36) into number
        if number=card field 1 or number=card field 2 or number=card field 3 or number=card
        field 4 or number=card field 5 or number=card field 6 then next repeat
        add 1 to count
        if count = 1 then put number into card field 1
        if count = 2 then put number into card field 2
        if count = 3 then put number into card field 3
        if count = 4 then put number into card field 4
        if count = 5 then put number into card field 5
        if count = 6 then put number into card field 6
    end repeat
end mouseUp
```

Searching Scripts. Here is an outline of a HyperCard script that you can use to search all scripts in a stack for the occurrence of some string of characters that interests you. You may wish to add an ASK command to your script that identifies the name of the stack that you are interested in searching. The container "what" is where you would have the text that you were searching for. The script below searches the stack script, the background script, background button scripts, background field scripts, card scripts, card button scripts, and card field scripts. It continues to search through all of these even if you have found what you wanted. Remember, if you want to interrupt a script at any time, press ⌘-period.

```
on search what
    get script of stack
    if it contains what then edit script of stack

    repeat with i=1 to the number of backgrounds
        go to card 1 of background i
        get script of background
        if it contains what then edit script of background

        repeat with j=1 to the number of background buttons
            get script of background button j
            if it contains what then edit script of background button j
        end repeat
```

```
        repeat with j=1 to the number of background fields
                get script of background field j
                if it contains what then edit script of background field j
        end repeat
    end repeat

    repeat with i=1 to the number of cards
        go to card i
        get script of this card
        if it contains what then edit script of this card

        repeat with j=1 to the number of card buttons
                get script of card button j
                if it contains what then edit script of card button j
        end repeat

        repeat with j=1 to the number of card fields
                get script of card field j
                if it contains what then edit script of card field j
        end repeat

    end repeat
end search
```

Add Sound to HyperCard. You can use a product called MacRecorder to record real sound into your Macintosh. The package includes HyperSound stackware, a stack that lets you record and work with sound from within HyperCard. Audiofile software records sound and lets you edit and save the file in a variety of formats including HyperCard, StudioSession, VideoWorks, and Beep INITs. Suggested retail price is $199. For more information, contact: Farallon Computing, 2150 Kittredge Street, Berkeley, CA 94704; (415) 849-2331.

HyperCard Stackware Information
The Whole Earth Learning Disc

***This is the first stage on the way toward an interactive version of* The Whole Earth Catalog.**

The Whole Earth Learning Disc is the first stage on the way toward an interactive version of *The Whole Earth Catalog* on compact disc. At present, it consists of a stack of about 7,000 cards. Each card pops up with a short review, a caption for its many illustrations and photographs, or a connection to music and sound. The Learning disk is linked to encourage browsing and to streamline searches. Self-education, arrived at by rewarding exploration, is the operating philosophy. Information about where you can get an item can be summoned at any time. The Whole Earth Learning Disc's nonlinear structure dismantles a number of artificial boundaries: between subjects, between styles of thinking, and between learning and playing.

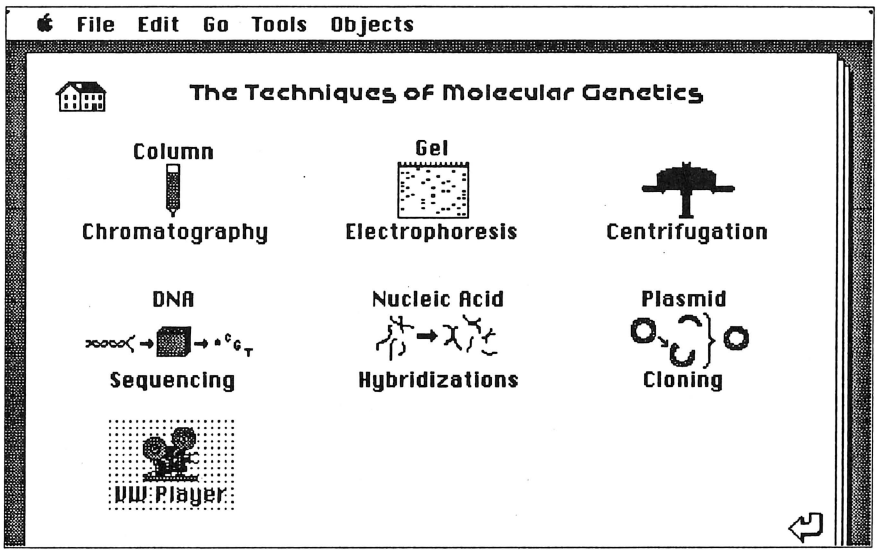
For more information, contact:
The Point Foundation
27 Gate 5 Road
Sausalito, CA 94965
(415) 332-1716

Lecture Helper

The Lecture Helper is a way to provide students with structured notes and graphics for a course. This stack allows the instructor to nest subtopics and to add text and graphics to expand upon topics. A demo is available that shows its use within a blood-banking course aimed at second-year medical students. The Glossary Maker is a companion stack for ANY other stack. It lets the stack author add definitions for any word in a field and lets the user move from any instance of that word in the stack to get the definition. It also performs sophisticated searches in the event of an imperfect match, matching the word to its root form. This stack has been completed.

For more information, contact:
Dr. J. Robert Beck
Dartmouth Medical School
Hanover, NH 03755-1870
(603) 646-8463

Interactive Molecular Genetics



The purpose of this stack is to demonstrate the potential of a full-blown stack detailing all of the techniques used in molecular genetics. By the nature of HyperCard, the stacks are extensible and, therefore, can be expanded as new techniques are developed. Through a series of icon selections, students can opt to learn about specific techniques, and see not only a hypertext description, but also graphics and animation. This is done in an interactive way, so that the amount of detail provided and the pace at which the information are displayed set by the student. The stack comes with a series of questions and answers about the techniques, to which new questions and answers can be added. Questions and answers can be saved as text files or merged with other stacks, using the utilities provided. This stack is still under development.

For more information, contact:
Bob Gross
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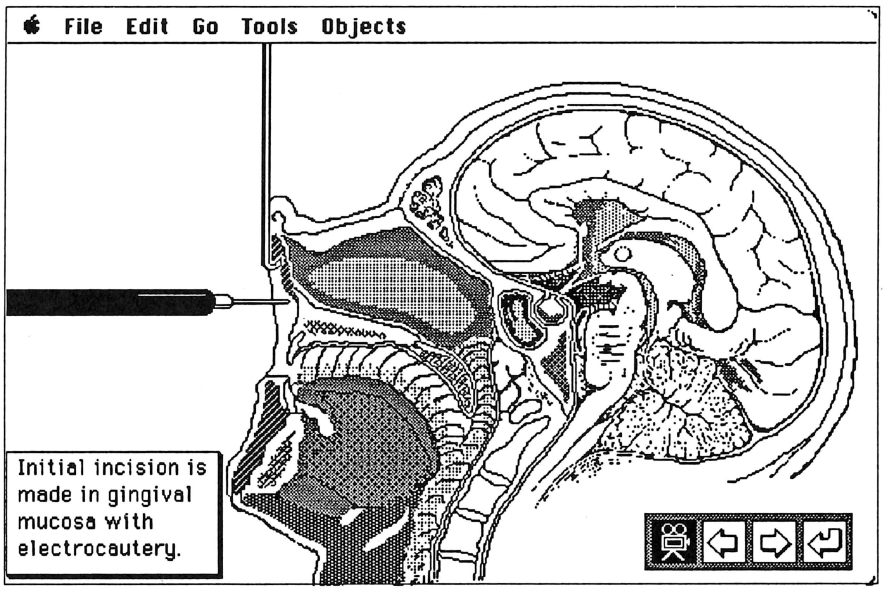
Interactive Medical Record Keeper



The Interactive Medical Record Keeper is a HyperCard application that employs videodisc technology, digitized sound, animation, and linkage to external programs to provide a computerized, comprehensive medical record. The intended user, the medical student, can interactively gain an overview of a patient by viewing X-ray findings and biopsy slides and/or hearing heart sounds, and can learn the complex anatomy of the brain through an animated surgical sequence. More experienced users are provided with extensive indexing schemes based on anatomical drawings to quickly find selected information. This stack is currently under development.

For more information, contact:
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Dartmouth Medical School
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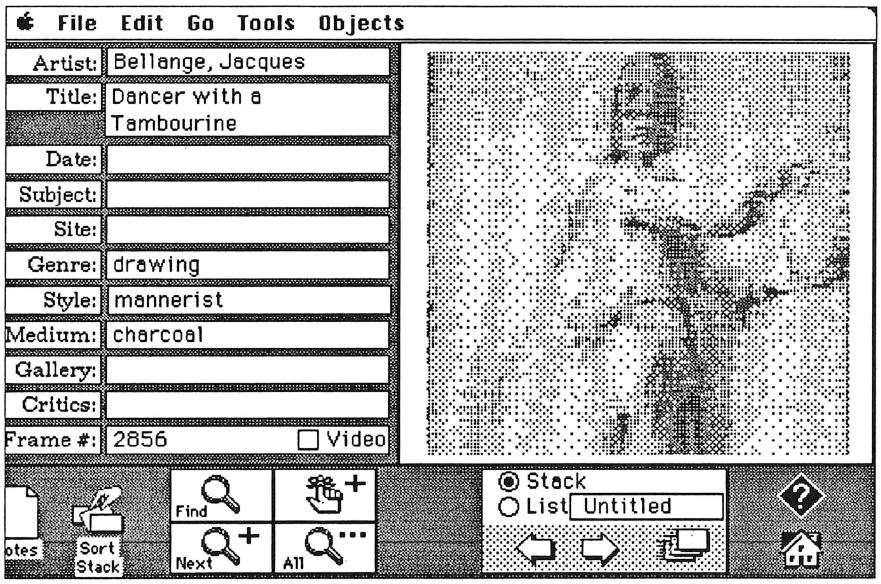
Mnemosyne



This application files and retrieves videodisc images. The HyperCard stack contains a card for each image of interest on videodisc. Users can search for matches on any combinations of fields; "marked" cards can be collected and shown in sequence. Mnemosyne controls Pioneer and other videodisc players, but it can be used for reference without a videodisc. This stack has been completed.

For more information, contact:
David Bantz
Humanities Computing
Dartmouth College
Hanover, NH 03755-1870
(603) 646-2712

Blood Banking

This set of stacks consists of handouts, a case problem, and a glossary that support a unit in a medical school hematology course on blood banking. It illustrates the hypertext features of HyperCard, and utilizes a series of tools for information organization known as the Lecture Helper (see description above). This stack has been completed.

For more information, contact:
Dr. J. Robert Beck
Dartmouth Medical School
Hanover, NH 03755-1870
(603) 646-8463

AIDS-HIV Testing

This set of stacks contains charts, pictures, text, and problem-solving cards related to testing for human immunodeficiency virus (HIV), the causative agent of acquired immune deficiency syndrome (AIDS). It allows the browsing user to explore the effect of different test strategies on the false positives and false negatives associated with testing. It also gives background information on the virus and its biology. It shows the graphic and calculational aspects of HyperCard, as well as the hypertext features. This stack has been completed.

For more information, contact:
Dr. J. Robert Beck
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Heavenly Mac

This computer "textbook" illustrates the history of astronomy from ancient times to Newton. The stack includes illustrations, text, and working models of celestial motion theories written in Pascal. This stack has been completed.

This stack illustrates the history of astronomy from ancient times to Newton.

For more information, contact:
Rich Kremer
History Department
Dartmouth College
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Quantum Mechanical Weirdness

This stack describes some of the quirks of Einstein's theories as compared to the classical theories. Animation within HyperCard is used to supplement text explaining the difference between wave and particle theories of light, and will, in future versions, be used to explain other classical vs. quantum "problems." This stack has been completed.

For more information, contact:
P. Bruce Pipes
Physics Department
Dartmouth College
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SmaugStat

This stack guides the user through information about elementary data analysis.

SmaugStat will provide the student or beginning researcher with an intelligent tutor for introductory social science statistics. In addition to guiding the user through information about elementary data analysis, SmaugStat also allows data input. Accordingly, the user may in turn be quizzed by SmaugStat as to the type of analysis intended, and problems with the data and alternative analyses may be suggested. It is hoped that users will customize and enhance SmaugStat to cover more areas than are covered by the original stack. Use of an underlying AI program (MacSmarts) is being explored. This stack is still under development.

For more information, contact:
George Wolford
Department of Psychology
Dartmouth College
Hanover, NH 03755-1870
(603) 646-2777/3181
or
Larry Levine
Social Science Computing
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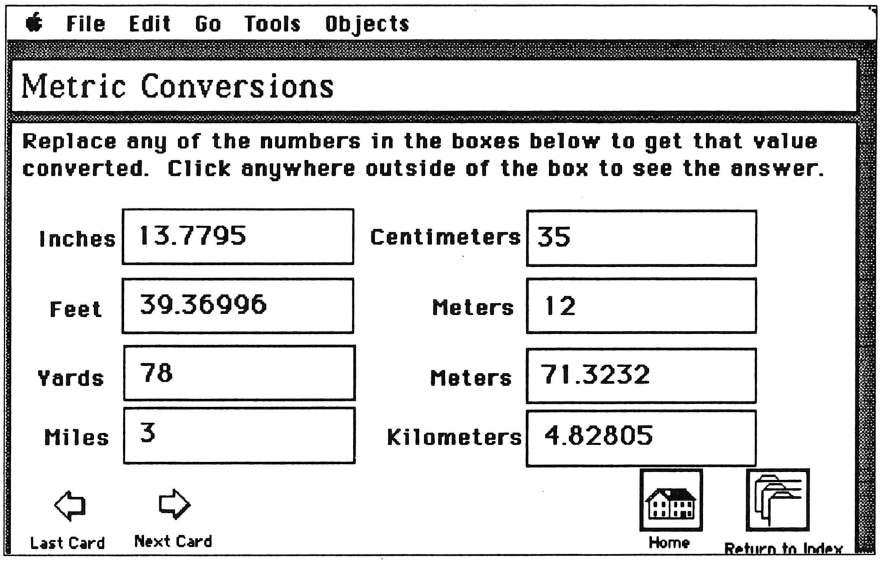
(603) 646-2783/3947

Electrical Circuits

This stack offers a demonstration of the properties of electricity. Graphic circuit diagrams can be operated with a switch, and the resulting voltages and currents are displayed on meters.

For more information, contact:
Robert Delaney
Physics Department
St. Louis University
221 North Grand Blvd.
St. Louis, MO 63103

Student Fact Stack



The Student Fact Stack is a stack of more than 100 cards that provide a wide variety of information of help and interest to students (for example, metric conversions, future values of an investment, time zones, resources, and bibliographic references). Topics include Math Facts, Reference Resources, and Money Management. This stack was written by a student for students. Send $10 along with your mailing address.

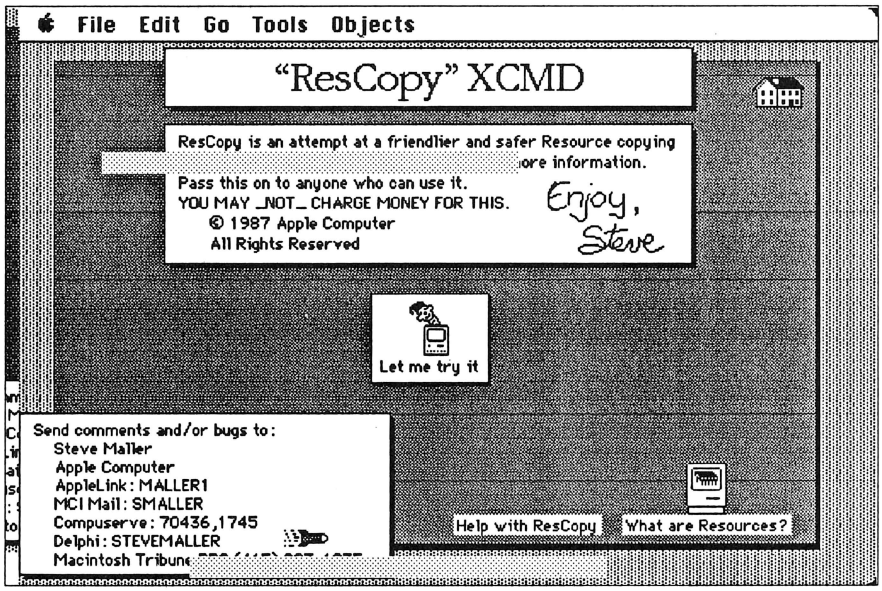
This stack was written by a student for students.

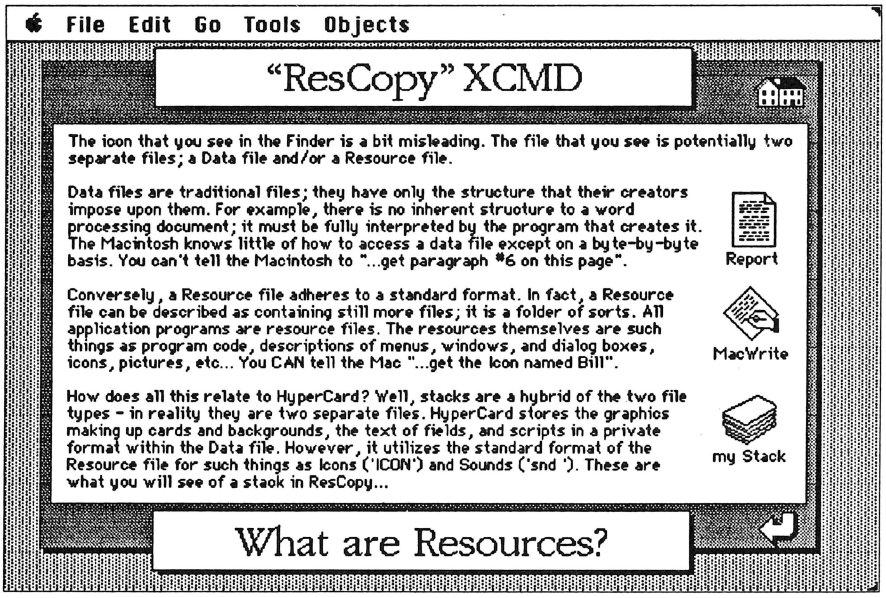
For more information, contact:
Kevin Olivieri
c/o Computer Sciences - F430
Boston College
Chestnut Hill, MA 02167

Copying Macintosh Resources

For those who are customizing their stacks, this is a very helpful utility.

This stack allows the user to easily copy resources from one stack to another. Thus, you can transfer sounds, XCMDs, menus, and so on into stacks of your choice—without using ResEdit. For those who are customizing their stacks, this is a very helpful utility. See the pictures below for an illustration of the features of this stack, as well as the information necessary to contact the designer. This stack is available on many of the electronic bulletin boards and from the public domain libraries of various Macintosh user groups.

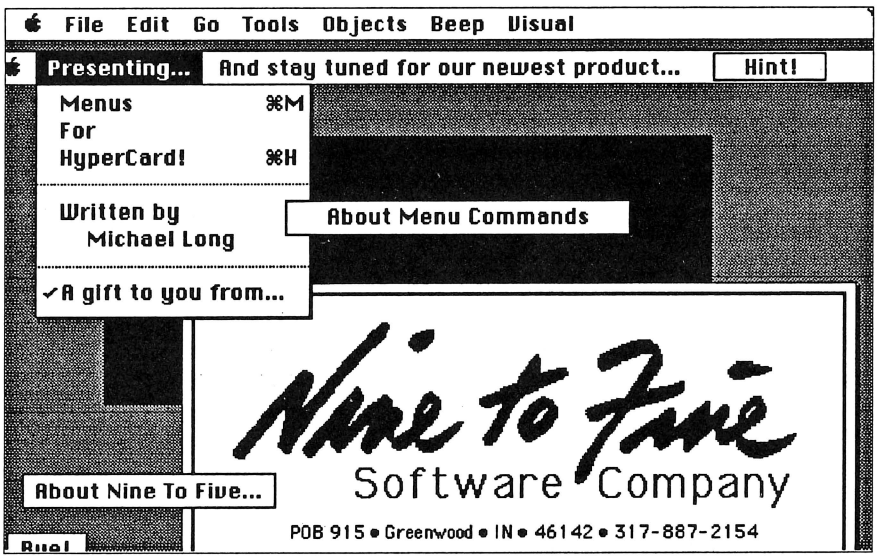


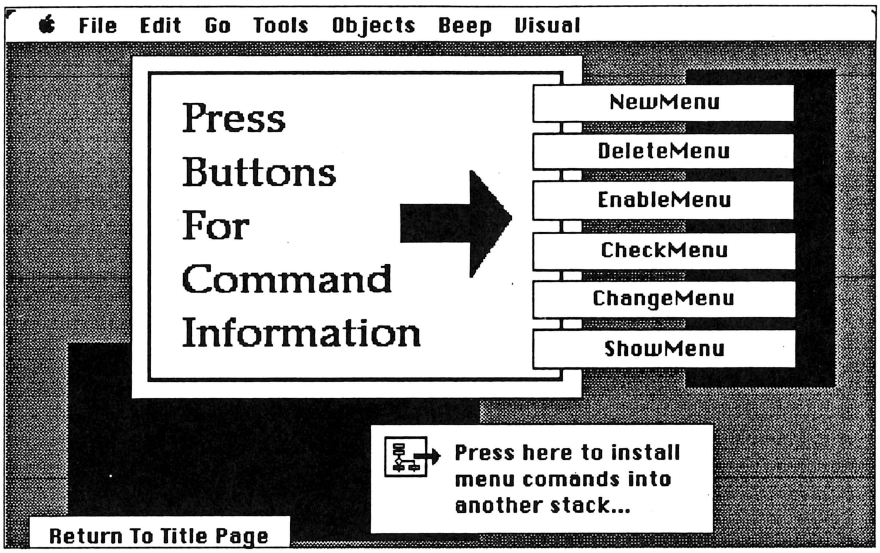


Adding Menus to HyperCard

This stack provides the user with the ability to add traditional Macintosh menus to a stack. There can be as many as eight menus on a card, and each of the menus can contain up to 15 items.

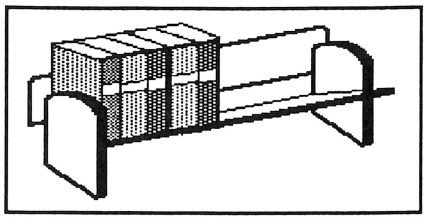
If you wish to customize your stacks to include traditional Macintosh menus, then this stack will be very helpful. With the XCMDs that are included here, you can add items to the menu bar, delete or edit menu items, place check marks beside items, and enable and disable menu items. Of course, your scripts can then test to see if a particular menu item has been selected and then take the appropriate action. See the illustrations that follow for information about this stack.





For more information, contact:
Michael Long
P.O. Box 915
Greenwood, IN 46142
(317) 887-2154

Resources



This issue's **Resources** section includes the references found in the fall issue. New articles are indicated with an ().

Business

Accountant, Inc. 1.0	MACWORLD	May 87	p. 161
Accountant, Inc.	MACUSER	Oct. 87	p. 48
Accountant, Inc.	MACAZINE	Oct. 87	p. 54
Accounting Software	MACWORLD	Oct. 87	p. 126
Accounting Software	MACUSER	Nov. 87	p. 136
AMS General Ledger 2.07	MACWORLD	Jan. 87	p. 127
Back to Basics	MACAZINE	Oct. 87	p. 52
BPI General Accounting	MACWORLD	Feb. 87	p. 149
Calendar Works	NIBBLE MAC	Mar. 87	p. 34
Check Mark Payroll 2.02	MACWORLD	Jan. 87	p. 127
Financial Calculator	NIBBLE	Nov. 87	p. 16
Great Plains Accounting Series	MACWORLD	Apr. 87	p. 165
In-House Accountant	MACWORLD	Nov. 87	p. 162
In-House Accountant	MACAZINE	Oct. 87	p. 44
Insight	MACAZINE	Oct. 87	p. 60
Insights on Microsoft Works	MACWORLD	Jul. 87	p. 195
Isgur Portfolio System	MACWORLD	Jan. 87	p. 203
Mac Tax Tools	MACWORLD	Feb. 87	p. 189
MacInTax	MACWORLD	Mar. 87	p. 141
MacMoney	MACAZINE	Oct. 87	p. 42
MacMoney 2.03	MACWORLD	Nov. 87	p. 152
Market Pro	MACWORLD	Jan. 87	p. 203
Market Pro	MACWORLD	Jan. 87	p. 124
MasterPiece 2.42	MACWORLD	Oct. 87	p. 157
Office Productivity System	MACWORLD	Jun. 87	p. 164
Optum-3 1.2A	MACWORLD	Oct. 87	p. 167
Parameter Manager 1.09	MACWORLD	Jan. 87	p. 129
Plains and Simple	MACAZINE	Oct. 87	p. 51
Project Billing	MACWORLD	Aug. 87	p. 154
Rags to Riches	MACWORLD	Jun. 87	p. 156
Rags to Riches	MACAZINE	Oct. 87	p. 46
Simulator	MACUSER	Dec. 87	p. 93
Tax Preparation	MACAZINE	Jan. 87	p. 48
The Investor	MACWORLD	Jan. 87	p. 203
Time Link	MACWORLD	Mar. 87	p. 153
Turbo Maccountant	MACAZINE	Oct. 87	p. 59

Computer Science

APL Plus	MACWORLD	Aug. 87	p. 153
Aztec C	MACWORLD	Apr. 87	p. 166
Basic Buttons & Fields	NIBBLE	Sep. 87	p. 31
Billboard Scroller	NIBBLE	Aug. 87	p. 33
Choosing a Language	MACWORLD	Oct. 87	p. 142
Consulair Mac C 5.0	MACWORLD	Jul. 87	p. 155
Cursor Hatching	NIBBLE MAC	Mar. 87	p. 44
Deleting Apple Menus	NIBBLE	Sep. 87	p. 28
Design	MACUSER	Apr. 87	p. 67
Expert System Program	NIBBLE	Aug. 87	p. 11
Expert Systems	MACUSER	Aug. 87	p. 143
FileCard	NIBBLE	Sep. 87	p. 9
LightspeedC	MACUSER	Apr. 87	p. 126
Lightspeed Pascal	MACWORLD	Feb. 87	p. 128
LogicWorks 1.02	MACWORLD	May 87	p. 162
MacFlow	MACWORLD	Mar. 87	p. 149
MacFlow	MACUSER	Apr. 87	p. 65
Mach 2 2.1	MACWORLD	Sep. 87	p. 161
MenuMaker	NIBBLE MAC	Mar. 87	p. 40
Microsoft BASIC Compiler	MACWORLD	May 87	p. 144
Multi-Voice Sound Control	NIBBLE MAC	Mar. 87	p. 38
Object Logo 1.0	MACWORLD	Jun. 87	p. 162
Overview of BASIC 3.0	NIBBLE MAC	Mar. 87	p. 28
Painter	NIBBLE MAC	Mar. 87	p. 15
PCMacBASIC	MACWORLD	May 87	p. 147
Printing in C	NIBBLE	Aug. 87	p. 42
Programming on the Mac	MACWORLD	Jun. 87	p. 135
Programming Tools	MACWORLD	Oct. 87	p. 213
RainBow Labeler	NIBBLE MAC	May 87	p. 13
Random Numbers in BASIC	NIBBLE	Oct. 87	p. 32
Sorting Routines	NIBBLE	Aug. 87	p. 36
Sound in C	NIBBLE	Sep. 87	p. 35
Strings in BASIC	NIBBLE	Oct. 87	p. 29
TDI MacModula-2	MACWORLD	Nov. 87	p. 155
TML Modula-2	MACWORLD	Dec. 87	p. 152
TML Pascal	MACWORLD	Feb. 87	p. 128
Turbo Pascal	MACWORLD	Apr. 87	p. 162
UNIX	MACUSER	Aug. 87	p. 83
Videotape Librarian	NIBBLE	Oct. 87	p. 9
V.I.P.	MACWORLD	May 87	p. 157
V.I.P.	MACUSER	Jun. 87	p. 132
V.I.P.	MACAZINE	May 87	p. 48
Windowing Techniques	NIBBLE	Aug. 87	p. 38
Zedcor's BASIC	MACWORLD	May 87	p. 145

Databases

4th Dimension	MACWORLD	Jul. 87	p. 122
4th Dimension	MACUSER	Nov. 87	p. 98
C.A.T.	MACUSER	Nov. 87	p. 117
Database Managers	MACWORLD	Jun. 87	p. 197
dMAC III	MACWORLD	Feb. 87	p. 152
FileMaker Plus	MACUSER	Jan. 87	p. 23
FileMaker Plus	MACWORLD	Jan. 87	p. 131
Helix	MACAZINE	Apr. 87	p. 34
Insights on OverVUE	MACWORLD	May 87	p. 191
MacDewey	MACUSER	Nov. 87	p. 82
Omnis 3 Plus	MACAZINE	Apr. 87	p. 33
Reflex for the Mac	MACUSER	Jan. 87	p. 23
Reflex for the Mac	MACAZINE	Apr. 87	p. 29
Scripting in FileMaker	NIBBLE	Oct. 87	p. 24

Education

A B sCenes	MACWORLD	Feb. 87	p. 158
Course Builder	MACUSER	Oct. 87	p. 137
Course Builder	MACWORLD	Dec. 87	p. 149
Course Builder	MACAZINE	Oct. 87	p. 18
Easy as ABC	MACWORLD	Feb. 87	p. 158
Elementary School Applications	MACUSER	Aug. 87	p. 117
Geometry Tutorial	MACWORLD	Feb. 87	p. 157
Guide	MACAZINE	May 87	p. 23
Guide	MACUSER	Apr. 87	p. 95
Guide: Authoring	MACWORLD	Feb. 87	p. 142
MacMathPac 1.1	MACWORLD	Jul. 87	p. 159
Math Blaster	MACWORLD	Apr. 87	p. 172
MicroChem 1.0	MACWORLD	Jun. 87	p. 154
Oyster	MACAZINE	Oct. 87	p. 19

Games

Arazok's Tomb	MACWORLD	Apr. 87	p. 171
Arcade Adapter	MACWORLD	Jun. 87	p. 159
Balance of Power	MACUSER	Sep. 87	p. 149
Battle Stations	MACUSER	Jun. 87	p. 73
Best Macintosh Games	MACWORLD	Dec. 87	p. 119
Bureaucracy	MACUSER	Aug. 87	p. 135
Bureaucracy	MACWORLD	Nov. 87	p. 161

Dark Castle	MACWORLD	Mar. 87	p. 146
Dark Castle	MACUSER	Apr. 87	p. 113
Down Hill Racer	MACUSER	Sep. 87	p. 68
Dungeons of Doom	MACUSER	Jan. 87	p. 118
Ferrari Grand Prix	MACWORLD	May 87	p. 163
First Shapes 1.0	MACWORLD	Nov. 87	p. 160
Hollywood Hijinx	MACUSER	Jun. 87	p. 67
Klondike	MACUSER	Dec. 87	p. 91
Lounge Lizards	MACWORLD	Dec. 87	p. 142
Mac Pro Football	MACWORLD	Jul. 87	p. 157
Mac Projects for Kids	MACWORLD	Mar. 87	p. 123
MacCourses	MACUSER	Apr. 87	p. 73
MacMan	MACUSER	Aug. 87	p. 74
MacRacquetball	MACUSER	Oct. 87	p. 59
MacRacquetball	MACWORLD	Nov. 87	p. 154
Maze Survival	MACUSER	Aug. 87	p. 58
Maze Wars + 1.1	MACWORLD	Oct. 87	p. 151
MicEdGames	MACUSER	Dec. 87	p. 96
NFL Challenge	MACUSER	Jun. 87	p. 69
NFL Challenge	MACWORLD	Jul. 87	p. 15
Ogre	MACUSER	Nov. 87	p. 94
OrbQuest	MACWORLD	Feb. 87	p. 150
Patton vs. Rommel	MACWORLD	Aug. 87	p. 151
Patton vs. Rommel	MACUSER	Apr. 87	p. 69
Portal	MACUSER	Oct. 87	p. 64
Seven Cities of Gold	MACUSER	Jun. 87	p. 108
Shadowgate	MACUSER	Sep. 87	p. 68
Shadowgate	MACWORLD	Sep. 87	p. 168
Shadowgate	MACUSER	Dec. 87	p. 192
Shanghai	MACWORLD	Jan. 87	p. 136
Snake-Bar	MACUSER	Dec. 87	p. 95
Space Quest	MACUSER	Sep. 87	p. 62
Space Quest	MACWORLD	Oct. 87	p. 165
Stationfall	MACUSER	Nov. 87	p. 78
Strategic Conquest II	MACWORLD	Jan. 87	p. 129
Sub Battle Simulation	MACUSER	Aug. 87	p. 60
Sub Battle Simulator	MACWORLD	Jul.. 87	p. 161
Tass Times in Tonetown	MACUSER	Jan. 87	p. 49
Tass Times in Tonetown	MACWORLD	Jun. 87	p. 165
The King of Chicago	MACWORLD	Jul. 87	p. 152
World Builder	MACAZINE	Jan. 87	p. 36
World Builder	MACUSER	Apr. 87	p. 10

Graphics

ANATOOL	MACWORLD	Jan. 87	p. 126
AutoCAD	MACWORLD	Nov. 87	p. 115
CheapPaint	MACWORLD	Jan. 87	p. 88
Color Page Layout	MACWORLD	Sep. 87	p. 147
Comic Strip Factory	MACUSER	Dec. 87	p. 167

Cricket Draw	MACWORLD	May 87	p. 148
Design	MACWORLD	Feb. 87	p. 148
EZ Draft	MACWORLD	Nov. 87	p. 115
FullPaint	NIBBLE MAC	May 87	p. 17
FullPaint	MACWORLD	Jan. 87	p. 88
Graphics Tools	MACWORLD	Aug. 87	p. 217
GraphicWorks	MACUSER	Apr. 87	p. 71
GraphicWorks	NIBBLE MAC	May 87	p. 17
GraphicWorks	MACWORLD	Jan. 87	p. 88
GraphicWorks 1.1	MACUSER	Sep. 87	p. 156
GraphicWorks 1.1	MACUSER	Oct. 87	p. 126
Graphidex 1.0	MACWORLD	May 87	p. 158
GrayPaint	MACUSER	Jan. 87	p. 81
Gridmaker 1.0	MACWORLD	May 87	p. 159
Illustrator	MACWORLD	Jun. 87	p. 117
ImageStudio	MACWORLD	Dec. 87	p. 138
Insights on MacPaint	MACWORLD	Feb. 87	p. 177
Insights on SuperPaint	MACWORLD	Dec. 87	p. 219
Japanese Clip Art	MACUSER	Apr. 87	p. 73
LaserPaint 1.1	MACWORLD	Sep. 87	p. 155
Mac3D	MACWORLD	May 87	p. 122
Mac3D 2.0	MACUSER	Jan. 87	p. 51
MacBillboard	MACWORLD	Jan. 87	p. 88
MacDraw Pasteup	MACWORLD	May 87	p. 203
Macintosh CAD	MACWORLD	Dec. 87	p. 97
Macintosh Drafting Software	MACWORLD	Jul. 87	p. 132
Macintosh Graphics	MACWORLD	Aug. 87	p. 193
MacMemories Series	MACWORLD	Mar. 87	p. 147
MacModel (3D)	MACWORLD	May 87	p. 120
MacMovies	MACWORLD	Mar. 87	p. 105
MacPaint	MACWORLD	Jan. 87	p. 88
Mechanical CAD	MACWORLD	Nov. 87	p. 115
MGM Station	MACWORLD	Nov. 87	p. 115
MGMS (CAD)	MACUSER	Nov. 87	p. 127
MiniCAD	MACWORLD	Nov. 87	p. 115
MiniCAD	MACUSER	Oct. 87	p. 59
MiniCAD 3.0	MACWORLD	Jun. 87	p. 158
Newsroom Graphics	MACWORLD	Feb. 87	p. 131
Phoenix 3D	MACWORLD	May 87	p. 120
Phoenix 3D Level 1.0	MACWORLD	Jan. 87	p. 125
PictureBase 1.2	MACUSER	Sep. 87	p. 66
PowerPoint	MACUSER	Aug. 87	p. 76
PowerPoint	MACAZINE	Sep. 87	p. 65
PowerPoint	MACWORLD	Jun. 87	p. 152
PowerPoint	MACAZINE	Oct. 87	p. 65
PrintWorks	MACUSER	Aug. 87	p. 64
Professional CAD	MACUSER	Jun. 87	p. 65
Sizer & Adjacency (CAD)	MACWORLD	Mar. 87	p. 150
SpaceEdit	MACWORLD	May 87	p. 123
SpaceEdit 1.5	MACWORLD	Jul. 87	p. 160
Storyboards	MACUSER	Aug. 87	p. 98
SuperPaint	MACUSER	Sep. 87	p. 156
SuperPaint	MACAZINE	Jan. 87	p. 69
SuperPaint	NIBBLE MAC	May 87	p. 17

SuperPaint	MACWORLD	Jan. 87	p. 88
The Print Shop	MACUSER	Sep. 87	p. 66
The Print Shop	MACWORLD	Apr. 87	p. 17
✒ VideoWorks Creator	MACAZINE	Oct. 87	p. 22
VideoWorks II 2.0	MACWORLD	Oct. 87	p. 159
WetPaint	MACUSER	Sep. 87	p. 62

Hardware

40 MB Disk Drives	MACUSER	Sep. 87	p. 81
✒ A Guide to Fans	MACWORLD	Nov. 87	p. 311
Approaching Mac II	MACWORLD	Jun. 87	p. 130
✒ AST TurboScan	MACUSER	Nov. 87	p. 91
Backup Tape Drives	MACWORLD	Aug. 87	p. 129
Beefing up the SE	MACWORLD	Sep. 87	p. 133
DataFrame 40-XP	MACWORLD	Apr. 87	p. 164
Digitizers and Scanners	MACWORLD	Jul. 87	p. 117
Disk Holders	MACWORLD	Oct. 87	p. 169
Filling the Macintosh Slots	MACWORLD	Apr. 87	p. 150
Hard Disk Comparison	MACAZINE	Sep. 87	p. 49
Hard Disk Drives Compared	MACWORLD	Jan. 87	p. 103
Hard Disk Storage Devices	MACWORLD	Jul. 87	p. 127
✒ Hard Disks	MACWORLD	Nov. 87	p. 148
✒Hard Disks Compared	MACWORLD	Dec. 87	p. 105
HD20SC	MACWORLD	Mar. 87	p. 140
✒ Image Scanner	MACUSER	Dec. 87	p. 68
Insights into LaserWriter	MACWORLD	Jan. 87	p. 185
✒ Installing Mac II Memory	MACWORLD	Dec. 87	p. 235
Introducing Macintosh II	MACWORLD	Apr. 87	p. 126
Laser Printers	MACWORLD	Sep. 87	p. 108
Laser Printers	MACUSER	Oct. 87	p. 84
Laser Printers	MACWORLD	Jun. 87	p. 123
LaserScript 2.16	MACWORLD	Sep. 87	p. 165
LaserWriter & the PC	MACWORLD	Sep. 87	p. 165
Levco one plus one	MACUSER	Aug. 87	p. 71
Mac Digitizers	MACWORLD	Mar. 87	p. 133
✒ Mac II Color Monitors	MACWORLD	Dec. 87	p. 91
✒Mac II Compatibility	MACWORLD	Nov. 87	p. 108
Mac Publishing Tools	MACWORLD	Jun. 87	p. 221
MAC-101	MACWORLD	Oct. 87	p. 153
MacADIOS System 1	MACWORLD	Jul. 87	p. 150
MacBottom 45	MACUSER	Oct. 87	p. 66
Macintizer Tablet	MACWORLD	Mar. 87	p. 143
Macintosh II	NIBBLE MAC	Mar. 87	p. 9
Macintosh II	MACUSER	Apr. 87	p. 74
Macintosh II and the SE	MACAZINE	Apr. 87	p. 23
Macintosh II Displays	MACWORLD	Jul. 87	p. 110
Macintosh SE	MACUSER	Apr. 87	p. 84
MacPlus Upgrade	MACWORLD	Mar. 87	p. 144

MacSnap Plus 2	MACUSER	Jun. 87	p. 73
MacTablet	MACWORLD	Mar. 87	p. 143
Magic 20 Hard Disk	MACWORLD	Sep. 87	p. 166
Nutmeg Page Display	MACAZINE	Oct. 87	p. 73
Omni Laser 2108	MACWORLD	Sep. 87	p. 157
One + One Upgrade	MACWORLD	Mar. 87	p. 144
PC MacKey	MACWORLD	Oct. 87	p. 153
PC-380 Bar Code Reader	MACWORLD	Apr. 87	p. 170
Personal Laser Printer	MACAZINE	Oct. 87	p. 37
Plus 20 Hard Disk	MACWORLD	Sep. 87	p. 166
Pocket Modem	MACUSER	Nov. 87	p. 84
Portable Macintoshes	MACWORLD	Feb. 87	p. 120
PS Print 1.01	MACWORLD	Sep. 87	p. 165
quadLynx Trackball	MACWORLD	Jun. 87	p. 161
Radius Accelerator SE	MACWORLD	Nov. 87	p. 151
Scanners	MACAZINE	Sep. 87	p. 91
SCSI Port Adaptors	MACWORLD	Feb. 87	p. 154
SE Close-up	MACWORLD	May 87	p. 113
Standby Power Systems	MACAZINE	Sep. 87	p. 68
Supercharged SE	MACUSER	Nov. 87	p. 149
"SuperRAM 2, 4"	MACUSER	Oct. 87	p. 52
T-20 Tape Backup System	MACWORLD	Feb. 87	p. 151
Tape Backup Systems	MACAZINE	Sep. 87	p. 38
TDBK-20+ Tape Backup	MACWORLD	Feb. 87	p. 151
The Faster ImageWriter	MACUSER	Jun. 87	p. 125
The Macintosh SE	MACWORLD	Sep. 87	p. 65
The Open Macintosh	MACWORLD	Apr. 87	p. 144
TimeWand	MACUSER	Dec. 87	p. 141
TOPS Print 1.08	MACWORLD	Sep. 87	p. 165
Trackballs	MACAZINE	Sep. 87	p. 35
TurboMouse	MACWORLD	Jun. 87	p. 161

Miscellaneous

AppleShare 1.1	MACWORLD	Oct. 87	p. 150
Backing Up Disks	MACWORLD	Feb. 87	p. 169
Best Mac for Your Company	MACUSER	Sep. 87	p. 56
Buying by Mail	MACWORLD	Mar. 87	p. 126
Calliope	MACWORLD	Feb. 87	p. 160
Clicktracks 2.0	MACWORLD	Sep. 87	p. 158
DataDesk 1.04	MACWORLD	Aug. 87	p. 157
Desktop Productivity	MACUSER	Jan. 87	p. S4
Desktop Video System	MACWORLD	Feb. 87	p. 153
EarthPlot 2.0	MACWORLD	May 87	p. 167
FastForms	MACUSER	Nov. 87	p. 78
FRAMEMAC 1.11	MACWORLD	Oct. 87	p. 158
Getting Started with Spooling	MACWORLD	Mar. 87	p. 173
Guide to Disk Carriers	MACWORLD	Apr. 87	p. 168
Hard Disk Medic	MACUSER	Dec. 87	p. 201

HyperCard	MACWORLD	Oct. 87	p. 123
HyperCard	MACAZINE	Oct. 87	p. 64
HyperCard	MACUSER	Dec. 87	p. 112
HyperCard Stacks	MACUSER	Dec. 87	p. 222
InBox: Mac E-Mail	MACWORLD	Feb. 87	p. 140
Interoffice Mail	MACAZINE	Oct. 87	p. 59
John Scully Interview	MACWORLD	Nov. 87	p. 73
LabVIEW	MACUSER	Aug. 87	p. 71
LabVIEW 1.0	MACWORLD	May 87	p. 155
Mac II Windows	MACWORLD	Nov. 87	p. 137
MacAcronyms	MACWORLD	Jan. 87	p. 175
MacAtlas 1.1	MACWORLD	May 87	p. 167
MacEqn	MACWORLD	Jan. 87	p. 133
Macintosh Maintenance	MACWORLD	Jul. 87	p. 185
MacRelax	MACUSER	Jan. 87	p. 49
MacWorld Buyer's Guide	MACWORLD	Nov. 87	p. 176
MacWorld Expo 87	MACAZINE	Apr. 87	p. 49
Mail Order Problems	MACWORLD	Dec. 87	p. 82
MapMaker	MACUSER	Jan. 87	p. 74
MapMaker 1.1	MACWORLD	May 87	p. 166
Mastering Mail Merge	MACWORLD	Sep. 87	p. 140
McCAD PCB	MACWORLD	Feb. 87	p. 155
Measure Up 1.0d	MACWORLD	Jan. 87	p. 134
MORE	MACUSER	Jan. 87	p. S8
Networking	MACWORLD	Sep. 87	p. 199
Networks and Gateways	MACWORLD	Oct. 87	p. 130
Picking the Right Mac	MACUSER	Sep. 87	p. 54
PowerMath 2.0	MACWORLD	May 87	p. 163
Product Directory	MACUSER	Sep. 87	p. S26
Public Domain Pranks	MACWORLD	Apr. 87	p. 156
Re-Inking Ribbons	MACUSER	Sep. 87	p. 165
Sound Lab 1.1	MACWORLD	Jul. 87	p. 156
Systat 3.1	MACWORLD	Sep. 87	p. 153
The Surgeon (Simulation)	MACWORLD	Mar. 87	p. 154
Typing Intrigue	MACWORLD	Mar. 87	p. 148
Typing Made Easy	MACWORLD	Mar. 87	p. 148
Up on the Big Screen	MACWORLD	Jan. 87	p. 88
Using HyperCard	MACWORLD	Dec. 87	p. 191
Vertical Mac Applications	MACUSER	Sep. 87	p. S18
Your Personal Poet	MACUSER	Jun. 87	p. 62

Music

Concertware+	MACUSER	Dec. 87	p. 100
ConcertWare+ MIDI	MACUSER	Dec. 87	p. 100
Cue: Film Music System	MACWORLD	Sep. 87	p. 158
Deluxe Music Construction Set	MACWORLD	Mar. 87	p. 142
Listen	MACUSER	Jan. 87	p. 47
Master Tracks Pro	MACUSER	Dec. 87	p. 180

MIDI Mac Sequencer	MACWORLD	Mar. 87	p. 142
Music & Personal Computers	MACWORLD	Aug. 87	p. 138
Music Between the Keys	MACUSER	Oct. 87	p. 146
Music for the Masses	MACUSER	Aug. 87	p. 126
Practica Musica	MACUSER	Nov. 87	p. 76
Starting with Music	MACWORLD	Nov. 87	p. 283
Studio Session 1.0	MACWORLD	Nov. 87	p. 158

Spreadsheets

Excel Macros	MACUSER	Oct. 87	p. 98
Excel Macros	MACWORLD	Nov. 87	p. 122
Excel Tips	NIBBLE	Aug. 87	p. 34
Excel Tips	NIBBLE	Sep. 87	p. 24
Excel Tips	NIBBLE	Sep. 87	p. 26
Excel Tips	NIBBLE MAC	Mar. 87	p. 30
Excel Tips	NIBBLE	Nov. 87	p. 30
Excel Tools	MACWORLD	Mar. 87	p. 191
Excel versus Lotus 1-2-3	MACUSER	Jan. 87	p. 18
Excellent Exchange	MACWORLD	Aug. 87	p. 151
MS Works and JAZZ	MACUSER	Jan. 87	p. S13
MS Works Info	MACAZINE	Oct. 87	p. 96
MS Works Tools	MACAZINE	Oct. 87	p. 96
Personal Training Systems	MACWORLD	Dec. 87	p. 143
Secrets of Excel	MACUSER	Jun. 87	p. 81
Trapeze	MACUSER	Jun. 87	p. 76
Trapeze 1.0	MACWORLD	May 87	p. 152
Trapeze 2.0	MACUSER	Dec. 87	p. 128
Using Excel Lookup	NIBBLE	Aug. 87	p. 26
Works: Mailing Labels	MACAZINE	Oct. 87	p. 98

Telecommunications

3Server3	MACWORLD	Jan. 87	p. 132
50 Mac Bulletin Boards	MACAZINE	May 87	p. 33
AppleShare	MACWORLD	Mar. 87	p. 108
AppleTalk Office	NIBBLE	Sep. 87	p. 14
Choosing a Modem	MACWORLD	Jul. 87	p. 138
Communications Gear	MACWORLD	May 87	p. 181
Communications Programs	MACAZINE	Feb. 87	p. 51
Communications Tools	MACWORLD	Sep. 87	p. 229
Desktop *Express*	MACWORLD	Oct. 87	p. 154
Easy E-Mail	MACWORLD	Sep. 87	p. 152
FModem	MACWORLD	Apr. 87	p. 173

Getting Started with Tele.	MACWORLD	Apr. 87	p. 187
Insights on Red Ryder	MACWORLD	Apr. 87	p. 199
inTalk	MACWORLD	Aug. 87	p. 160
InterBridge 1.05	MACWORLD	Jun. 87	p. 157
InterMail 1.0	MACWORLD	May 87	p. 154
Listen	MACWORLD	Dec. 87	p. 148
Maxwell Modem	MACWORLD	Jul. 87	p. 153
Mock Terminal	MACWORLD	Apr. 87	p. 173
MultiTalk MT100	MACWORLD	Dec. 87	p. 145
NetModem V1200	MACWORLD	Dec. 87	p. 145
Netway N1000A	MACWORLD	Nov. 87	p. 1
Networking Report	MACAZINE	Oct. 87	p. 41
Networks Explained	MACAZINE	Oct. 87	p. 42
pc Link 3.9	MACWORLD	Nov. 87	p. 161
PhoneNet System	MACWORLD	Dec. 87	p. 136
Red Ryder 10.0	MACUSER	Dec. 87	p. 152
Terminal Emulators	MACWORLD	May 87	p. 135
TermWorks	MACWORLD	Apr. 87	p. 173
VersaTerm-PRO	MACUSER	Apr. 87	p. 69

Utilities

1st Aid Kit	MACWORLD	Jul. 87	p. 153
AutoMac II 2.0	MACWORLD	Nov. 87	p. 159
C.A.T. 1.0	MACWORLD	Oct. 87	p. 164
CalendarMaker	MACWORLD	Mar. 87	p. 152
CalendarMaker	NIBBLE	Oct. 87	p. 21
Comment	MACUSER	Nov. 87	p. 158
Comment 1.0	MACWORLD	Oct. 87	p. 167
Desk Accessories	MACWORLD	Aug. 87	p. 120
Desk Accessories	MACWORLD	Oct. 87	p. 187
Desk Necessities	MACWORLD	Jun. 87	p. 167
DeskTop 2.0	MACWORLD	Aug. 87	p. 146
Desktop *Express*	MACAZINE	Oct. 87	p. 82
Desktop Tools	MACWORLD	Jan. 87	p. 195
Disk Express	MACWORLD	Feb. 87	p. 156
Disk Librarian	MACUSER	Apr. 87	p. 65
Disk Tools II	MACWORLD	Dec. 87	p. 144
DiskFit	NIBBLE	Oct. 87	p. 20
DiskFit	MACUSER	Jun. 87	p. 69
DiskTop	NIBBLE	Oct. 87	p. 19
DiskTop 2.0	MACUSER	Aug. 87	p. 60
File First Aid	MACWORLD	Apr. 87	p. 220
Findswell	MACWORLD	Dec. 87	p. 146
Findswell	MACAZINE	Oct. 87	p. 23
Findswell	MACUSER	Nov. 87	p. 80
Hard Disk Backups	MACAZINE	Feb. 87	p. 58

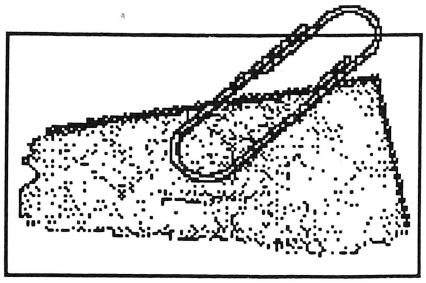
Hard Disk Partitioning	MACWORLD	Aug. 87	p. 158
HFS Navigator	MACAZINE	Oct. 87	p. 26
inLarge 1.0	MACWORLD	Aug. 87	p. 162
Insights on More	MACWORLD	Aug. 87	p. 205
LaserWriter Spoolers	MACWORLD	Jun. 87	p. 142
LookUp	MACWORLD	Dec. 87	p. 146
LookUp	MACUSER	Dec. 87	p. 90
Mac System Tools	MACWORLD	Jul. 87	p. 203
MacInUse	MACUSER	Jan. 87	p. 49
MacInUse 1.0	MACWORLD	Jul. 87	p. 158
MacLink Plus	MACWORLD	Apr. 87	p. 163
MacSafe 1.03	MACWORLD	Jun. 87	p. 166
Memorandum	MACUSER	Sep. 87	p. 77
MergeWrite	MACUSER	Dec. 87	p. 98
More Desk Accessories	MACUSER	Apr. 87	p. 120
MultiFinder	MACWORLD	Oct. 87	p. 109
MultiFinder	MACAZINE	Oct. 87	p. 36
myDiskLabeler	MACUSER	Aug. 87	p. 58
Partner	MACUSER	Sep. 87	p. 64
PowerStation	MACWORLD	Dec. 87	p. 150
PowerStation	MACUSER	Dec. 87	p. 88
Printworks 3.1	MACWORLD	Sep. 87	p. 154
RamSnap	MACUSER	Jun. 87	p. 67
Scrapbook Magic	MACAZINE	May 87	p. 52
Scrapping Scrapbooks	MACUSER	Jun. 87	p. 101
SideKick 2.0	MACWORLD	Oct. 87	p. 156
SideKick 2.0	MACUSER	Jun. 87	p. 70
SmartScrap	NIBBLE	Oct. 87	p. 18
SmartScrap	MACWORLD	Jul. 87	p. 148
Softsynth 2.0	MACWORLD	Oct. 87	p. 162
Sound Designer 1.12	MACWORLD	Oct. 87	p. 162
Stepping Out	MACUSER	Jun. 87	p. 67
Stepping Out 1.0	MACWORLD	Oct. 87	p. 161
Suitcase	MACWORLD	Dec. 87	p. 150
Suitcase	MACUSER	Nov. 87	p. 111
The Clipper	MACWORLD	Jul. 87	p. 148
TurboCharger 2.0	MACUSER	Jan. 87	p. 47

Word Processing

ACTA	NIBBLE MAC	Mar. 87	p. 25
An ACTA Brilliance	MACAZINE	Jan. 87	p. 32
Color Publishing	MACWORLD	Nov. 87	p. 126
Desktop Publishing	MACWORLD	Sep. 87	p. 124
Desktop Publishing	MACWORLD	Jan. 87	p. 113
Desktop Publishing Software	MACUSER	Jun. 87	p. 90
Font Facts	MACWORLD	Feb. 87	p. 113
Fontographer	MACUSER	Sep. 87	p. 114

Fonts of the World	MACWORLD	May 87	p. 126
Grep-WC 1.1	MACWORLD	Sep. 87	p. 163
Inside OutLiners	MACWORLD	Dec. 87	p. 124
Insights on Microsoft Word	MACWORLD	Mar. 87	p. 183
Insights on Ready Set Go	MACWORLD	Jun. 87	p. 209
Insights on XPress	MACWORLD	Nov. 87	p. 301
JustText	MACUSER	Sep. 87	p. 156
Kadmos Greek Fonts	MACUSER	Sep. 87	p. 23
Mac-Hy-phen 1.0	MACWORLD	Jan. 87	p. 135
MacProof	MACWORLD	Mar. 87	p. 151
MacProof	MACAZINE	Feb. 87	p. 18
MacProof	MACUSER	Apr. 87	p. 101
MacPublisher III	MACWORLD	Dec. 87	p. 139
MacSpec 2.0	MACWORLD	Aug. 87	p. 156
MergeWrite	MACWORLD	Dec. 87	p. 151
Microsoft Word	MACWORLD	Mar. 87	p. 116
Microsoft Word 3.0	MACWORLD	Sep. 87	p. 215
MindWrite	MACUSER	Aug. 87	p. 90
MindWrite	MACWORLD	Apr. 87	p. 160
MindWrite	NIBBLE MAC	Mar. 87	p. 18
MindWrite	MACAZINE	May. 87	p. 42
miniWriter 1.34	MACWORLD	Sep. 87	p. 163
MORE	NIBBLE MAC	Mar. 87	p. 20
Newsletter Templates	MACWORLD	Jul. 87	p. 151
PageMaker 2.0	MACWORLD	Sep. 87	p. 150
PageMaker 2.0	MACWORLD	Sep. 87	p. 203
PageMaker 2.0	MACUSER	Sep. 87	p. 70
PageMaker Portfolio	MACWORLD	Jul. 87	p. 151
PostScript	MACAZINE	Feb. 87	p. 29
Print Services Primer	MACWORLD	Aug. 87	p. 115
Professional Bibliographer	MACWORLD	Jan. 87	p. 129
Publishing Programs	NIBBLE	Nov. 87	p. 9
Ragtime	MACWORLD	Feb. 87	p. 146
Ragtime	MACUSER	Apr. 87	p. 89
ScriptWriter 1.17	MACWORLD	Nov. 87	p. 156
Secrets of Microsoft Word 3.0	NIBBLE MAC	May. 87	p. 47
Smart Quotes 1.1	MACWORLD	Sep. 87	p. 163
Smart Words	MACWORLD	Dec. 87	p. 141
SpellCheck	MACWORLD	Mar. 87	p. 145
Spelling Champion 2.2	MACWORLD	Jul. 87	p. 162
Spelling Checker Comparisons	MACWORLD	Sep. 87	p. 115
Spellswell	MACWORLD	Dec. 87	p. 146
Spellswell 1.3J	MACWORLD	Aug. 87	p. 150
Starting with PostScript	MACWORLD	Dec. 87	p. 171
Textures 0.8	MACWORLD	Jan. 87	p. 128
Thunder 1.0	MACWORLD	Jun. 87	p. 160
Tools for Writers 1.1	MACWORLD	Sep. 87	p. 162
Tools of the Trade	MACUSER	Sep. 87	p. 136
VOILA	NIBBLE MAC	Mar. 87	p. 25
VOILA	MACWORLD	May 87	p. 164
Word 3 Style	NIBBLE	Nov. 87	p. 18

Word Processing Comparison	NIBBLE	Aug. 87	p. 16
Word Processing Tools	MACWORLD	Sep. 87	p. 225
Word Tools	MACWORLD	Sep. 87	p. 162
Word Tools	MACAZINE	Oct. 87	p. 29
Works Plus Spell	MACUSER	Sep. 87	p. 48
Works Plus Spell 1.0	MACWORLD	Nov. 87	p. 156
WriteNow	MACAZINE	Feb. 87	p. 55
WriteNow	MACWORLD	Jan. 87	p. 122
Writer's Workshop	MACUSER	Apr. 87	p. 67
XPress	MACUSER	Sep. 87	p. 92
XPress 1.01	MACWORLD	Aug. 87	p. 148



Project Reports

This section of *Wheels for the Mind* presents many of the projects that are being developed at various colleges and universities. The listings are not restricted to Consortium schools or to schools in this country; you will find projects that are being done at universities all over the world.

Some of the items listed here are just in the beginning stages, while others are completed and ready for distribution.

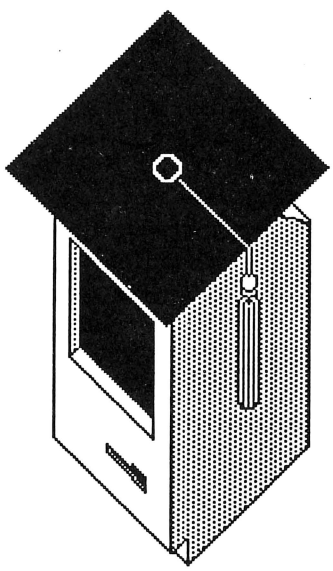
Rather than accumulating more and more reports, repeating them issue after issue, we are trying to list only new projects, or projects that have recently been further developed or updated.

Wherever possible, we have tried to list an appropriate contact, in case you are interested in finding out more about a listing.

One of the original intents of organizing educational institutions around the Macintosh was to provide opportunities for creative people to share their expertise and talents. We are sure that you will find much of that creativity in evidence here.

Please feel free to collaborate on developing an application, to develop one on your own, or simply to use one that was developed by one of your colleagues.

Most important, let us know what YOU are working on. Perhaps there are others around the world who might like to work with you! Send us a description of your project.



Authoring Tools

LessonWriter v. 2.2

LessonWriter allows a student or instructor to create interactive tutorial lessons quickly and easily. It is also an authoring tool for instructors to develop lessons, quizzes, and tests, and for students to use as an aid for individual study. In addition to providing a framework for writing questions of varying detail and sophistication, this program allows the author to provide the user with hints, pictures, and diagrams.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

LessonWriter for Chemistry Lessons v. 2.2

This version of LessonWriter includes two sample lessons on inorganic nomenclature and a MacPaint document of pictures of laboratory equipment, which can be used in the creation of new lessons, tests, or lab reports.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Biology

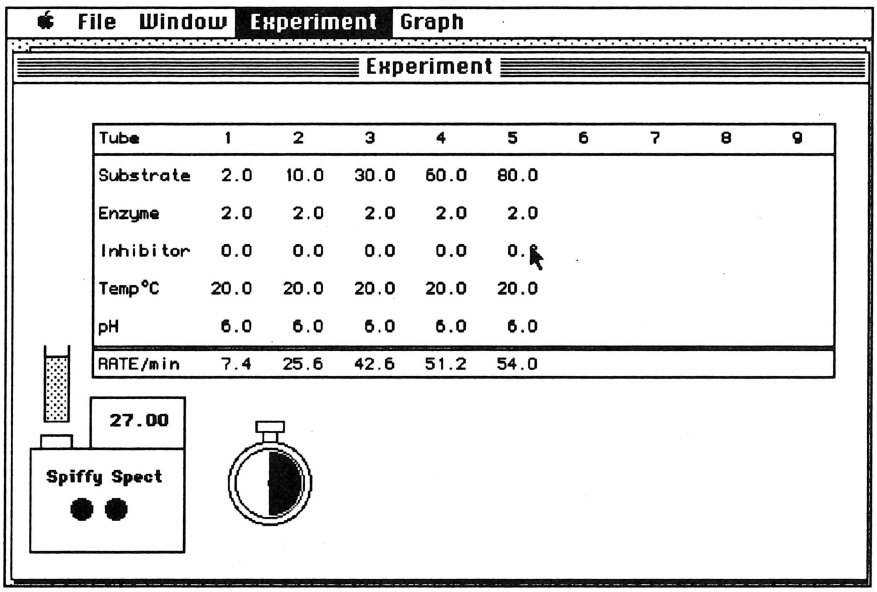
Enzyme Kinetics

SIMZYM is a simulated exercise on enzyme kinetics that is designed to provide students with intellectual and analytical experiences comparable to those of an actual laboratory study. The program's intended audience is freshman or sophomore students, but it is also appropriate for use with upper-division students. Controllable variables include substrate concentration, enzyme concentration, inhibitor concentration, temperature, and pH. Analytical tools include Lineweaver-Burk and Hanes transformations for estimating the Michaelis constant, an Arrhenius plot for estimating energy of activation, and a least-squares linear fit for slope and intercept estimates on linear or linearized functions. The program provides appropriate graphing options for the analysis.
Current status: In final revision following classroom testing.
Contact: Dr. Donald B. Heckenlively, Biology Department, Hillsdale College, Hillsdale, MI 49242

Biology

Computer Models of Genetic and Developmental Control of Biological Patterns

Interactions among genes that control wing pattern in butterflies appear to follow rules similar to those used in computer window displays. This project uses one workstation to explore this analogy by asking to what degree this relationship can be used to simulate events of ontogeny and evolution in wing pattern. The project also develops software for the analysis of multigene genetic crosses. Final users include undergraduate and graduate students.
Current status: In progress.
Contact: Biology Department, University of Texas, Austin, TX 78712



Business

Computer Implementation of Actuarial Models for Teaching and Research

Spreadsheets are used experimentally for research and teaching in actuarial modeling. Two workstations are used. Intended final users will be undergraduate and graduate students.
Current status: In progress.
Contact: Samuel H. Cox, Jr., Finance, University of Texas, Austin, TX 78712

Business

Knowledge Representation of Integrated Financial Management, Personnel, and Infrastructure Systems

This project uses the Macintosh computer to conduct research and to develop curricular material and software for knowledge representation of integrated public-sector information systems. Such systems include information on budget, personnel, infrastructure, and various verbal and symbolic data. Final users will be undergraduate and graduate students.
Current status: Ongoing.
Contact: David Eaton, LBJ School of Public Affairs, University of Texas, Austin, TX 78712

Managerial Use of Computers in Corporate Finance

The objective of this project, which has two workstations, is to facilitate full integration of the computer into the corporate finance course offerings in the Business School. The project attempts to develop a "library" of computerized case studies that can be shared among all the corporate finance courses taught in the department. Original software is being developed for this project and will be available. Final users include undergraduate and graduate students.
Current status: In progress.
Contact: Steven Flint and John Martin, Business Administration, University of Texas, Austin, TX 78712

Expert System Finance Tutor

This project is using one workstation for the development of an expert system for finance tutoring. The system tirelessly generates new problems and provides intelligent guidance to assist the student in mastering the material at his or her own pace. The system will be used by undergraduate as well as graduate students.
Current status: In progress.
Contact: John W. Kensinger, Business Administration, University of Texas, Austin, TX 78712

Data Simulation

Data Simulation is a program to create and administer questionnaires, and then massage the collected data to simulate a greater number of respondents whose responses match the pattern of the real respondents' answers.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Business

OEDE

Operation Encounter Data Entry—a program to set up and prepare data before transfer to a mainframe business simulation package.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

PERT/CPM

Project management software for learning about large-scale planning and scheduling.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Chemistry

General Chemistry, Multiplan Templates v. 1.0

This program contains four Multiplan templates: percentage composition, equilibrium concentrations, acid-base titration curves, and linear regression. The MolMass template calculates the molecular weight and percentage composition of any compound. EquilCalc calculates the equilibrium concentrations of the general chemical reaction aA + bB = rR + sS, given the initial concentrations and the equilibrium constant. AcidBase Titr and LSQ are the other two templates.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

KSIMS v. 1.1

KSIMS allows you to perform numerical experiments with simple chemical reactions such as A + B + C = D + E. You choose one of the 20 stored reactions and set initial conditions such as temperature and concentration. You then run the reaction and collect data on the concentration of each species at up to 30 time intervals you select.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Chemistry

MacStereo (R/S) v. 3.31

MacStereo (R/S) is a program designed to illustrate the Cahn-Ingold-Prelog stereochemical designation system. The program presents the correct designation procedure for molecules with one chiral center using static text and four interactive examples and presents nine interactive problems of increasing complexity. In the last two problems, the chiral center is located on a ring.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Molecular Editor v. 1.1

Molecular Editor allows the user to build and edit structures of more than 100 atoms from any element in the periodic table. Three-dimensional versions of Cut, Copy, and Paste allow the building of molecules from an initial collection of basic structures and functional groups. The program also has the ability to rotate molecules and measure the distance between any two atoms.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Molecular Editor Demo v. 1.0

Molecular Editor Demo is a demonstration version of Molecular Editor (see Molecular Editor entry), a software-based construction kit for building molecules, crystals, and other three-dimensional structures. Molecules containing any element in the periodic table can be built and edited on screen. You can draw structures in various ways (ball and stick, wire frame, space-filling) and rotate a molecule through any angle about any axis.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Molecular Weight Calculator v. 1.0

Molecular Weight Calculator is a desk accessory that permits the user to calculate the molecular weight (sometimes called molar mass) of any element or compound whose chemical formula is known. Both the formula and the molecular weight can be copied, cut, and pasted into other applications or into the standard Calculator desk accessory.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Chemistry

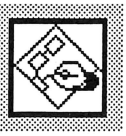
PeriChart v. 1.3

PeriChart is a database of atoms and elements that can be searched easily through interaction with an electronic display of the periodic chart. Pull-down menus enable the user to manipulate the data and to select practice exercises for use by students learning basic nomenclature and positioning within the periodic chart. PeriChart is a useful tool for students at all levels, as well as for serious professionals. Version 1.2 is available now, and v. 1.3 will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Pascal Pointers (Pointer Demo) v. 1.43

Pascal Pointers provides users with a mechanism for learning to use pointers and dynamic variables in Pascal. The concept arose from the difficulty Drexel students had exhibited in learning this material in programming courses. The user is allowed to enter commands from a subset of Pascal commands that use pointer variables. This material is fundamental for further computer science work. Version 1.5 will be released in early 1988 under the name Pointer Demo.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Computer Science



Computer Science Graphics

This project involves displaying Macintosh-generated graphics using a Tektronix 4128 terminal on a VAX 11/750 system. Recent work involves image digitization using a Macintosh Plus and the MacVision video digitizer. The MacVision system provides gray-value information of 256 levels of gray per pixel. Resulting gray values are used by the MacVision software to produce a halftone image. These screen images are easily saved as 1-bit-deep MacPaint files.

Computer Science

To access the full range of gray-value information, project participants developed a Pascal program that treats the MacVision software as a resource of Type DRVR. Gray-map text files of 8 bits per pixel are prepared and transferred to a VAX 11/780 minicomputer. In this environment, the images are processed and displayed on Tektronix terminals, taking advantage of the full range of gray-value information.
Current status: Ongoing.
Contact: Sam Drogo, Life Science Department, Mohawk Valley Community College, 1101 Sherman Drive, Utica, NY 13501; (315) 792-5409

SISO v. 1.5

This program, which aids in decision making and data preparation for mainframe applications, will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Economics

Review Units for Economics I

Ten units cover various aspects of supply-and-demand analysis. Random generation of numbers provides unique problems for each use. Response feedback is provided. Students receive scoring information that can be printed out for presentation to the instructor.
Current status: Completed and available.
Contact: Dr. Edward Koziara, College of Business and Administration, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2125

Education

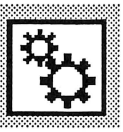
Spanish CAI for Bilingual Education Students

Four workstations are used to aid bilingual education students who want to improve their written Spanish language skills. Original software is being developed and will be available. Final users include upper-division students.
Current status: In progress.
Contact: George M. Blanco, Curriculum and Instruction, University of Texas, Austin, TX 78712

Study Skills

This program leads students through a series of questions and exercises intended to help them assess their study skills. The program will also tutor students in these skills. The goal of the program is to make learning study skills fun.
Current status: In development.
Contact: Craig Werth, Training in Academic Skills Center, 21 Madbury Road, University of New Hampshire, Durham, NH 03824

Engineering



Computational Fluid Dynamics Teaching and Research Laboratory

Students in computational fluid dynamics use Macintosh computers and Microsoft FORTRAN to solve large-scale problems involved in describing airflow around various airfoil shapes. Nine workstations are used for this project. Original software is being developed and will be available. Final users will include junior, senior, and graduate-level students.
Current status: Ongoing.
Contact: Graham Carey, Aerospace Engineering and Engineering Mechanics, University of Texas, Austin, TX 78712

Engineering

Three-Dimensional Model for Plotting Building "Envelopes"

During the last four semesters, the Texas A&M University Center for Urban Affairs, in association with the University's Department of Urban and Regional Planning, prepared a comprehensive urban-design study of the famed River Walk along the San Antonio River in downtown San Antonio. As a means of implementation, the team of Professors Wolfgang G. Roeseler, Jesus H. Hinojosa, Gordon Echols, and Achmad Djunaedi designed a three-dimensional-modeling program for plotting building "envelopes" on the Macintosh Plus. Using an extensive database of pertinent property information and sun angles calculated to allow a minimum of four hours of sunlight penetration (to avoid an otherwise inevitable "canyon effect" and thus protect subtropical vegetation along the river), the Macintosh will generate a theoretical three-dimensional wire-diagram geometric configuration called an "envelope." This envelope defines graphically the maximum dimensions of any new structure, or modified existing structure, in compliance with the urban-design criteria developed by the team. These criteria include both sun angles and protection of aesthetically significant vistas and view corridors. We believe that this technology is practical, economical, and generally applicable to cities with similar objectives.

Current status: Completed.

Contact: Program and documentation may be obtained from the Texas A&M University Center for Urban Affairs, Texas A&M University, College Station, TX 77843-3137; (409) 845-7883

Transmission-Line Simulator

This program simulates both transient and steady-state behavior of transmission lines and provides dynamic displays of voltage and current waves. The type of input, source and load impedances, line length, and attenuation may all be selected.

Current status: Available from Kinko's Academic Courseware Exchange.

Contact: ACE, 4141 State St., Santa Barbara, CA 93110; 800-235-6919, or in California, 800-292-6640

PipeFlow v. 1.0

PipeFlow is a program that facilitates the design of a pipeline carrying the steady-state flow of an incompressible liquid between two reservoirs. This program will be released in early 1988.

Current status: Completed.

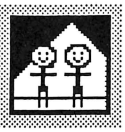
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Engineering

Statics

A series of programs that teach the basic concepts of statics.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Fine Arts



Development of a Computerized Electronic Chalkboard to Aid in Teaching Fundamentals of Directing for the Stage

A novel use of the Macintosh in drama, this project creates design and technical drawings using MacDraft, as well as data-manipulation templates for lighting designers and technical directors using Microsoft File and Multiplan. One workstation is used. Original software templates are being developed by this project and will be available. Final users include undergraduate and graduate students.
Current status: Ongoing.
Contact: Robert Schmidt, Drama, University of Texas, Austin, TX 78712

History

Project: Treaty of Versailles v. 1.0

Treaty of Versailles consists of a series of exercises that help students understand the main problems confronting the diplomats who drafted the treaties ending World War I. Exercise I has two parts: an exercise in which students redraw the map of Europe using national, ethnic, historical, and other relevant information they have studied; and a classroom simulation of a delegation meeting at the Versailles Conference. Exercise II consists of a series of questions about the territorial, disarmament, and reparation terms of four treaties. Students receive feedback on correct and incorrect answers.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

History

Vocabulary Drill v. 1.0

The program is based on 300 general vocabulary words used in McKay's *A History of Western Society* (Houghton Mifflin Company). Students match words to definitions provided. The words are used in a historical context to provide clues for students.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Liberal Arts

Writing Lab Project

Two Macintosh computers are used for developing original educational software to be used in a writing lab. The software will be available. Final users include undergraduate and graduate students.
Current status: In progress.
Contact: Jerome Bump, English, University of Texas, Austin, TX 78712

Macintosh English

This fall, six instructors are offering 13 sections of freshman composition and 11 hours of open classroom time each week in a classroom that contains 32 Macintosh SE computers and 8 ImageWriter printers. The project, which uses MacWrite and MacProof, emphasizes writing as a process. With the assistance of the district's Department of Research, we will compare student success and attitude in our computerized classes with student success and attitude in more traditional freshman composition classes.
Current status: Ongoing.
Contact: Eddye S. Gallagher, Asst. Professor of English, Tarrant County Junior College, Northeast Campus, 828 Harwood Rd., Hurst, TX 76054; (817) 281-7860, ext. 406 or 412

Mathematics and Statistics

ALPAL v. 2.0

This program solves linear programming by the graphical method (limited to eight constraints), and the algebraic and simplex methods (each limited to 30 decision variables and 30 structural constraints). Sensitivity analysis on the objective coefficients and the right-hand sides are provided. Dual L.P.S. are constricted by the program. Several format and printing options are possible.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Baysian Decision Tree

Tutorial for students encountering the principles of the Baysian Decision Tree.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Big ALPAL v. 1.0

Big ALPAL is a tool to be used to solve linear programming problems. The maximum size of the problems that can be solved ranges from 19 decision variables and constraints for a 128K Macintosh to more than 300 on a Macintosh Plus. All solutions include sensitivity analysis. The program allows the user to view the current model in two modes and under formulation.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Differential Equations

This program will provide graphical solutions for scalar differential equations.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Mathematics and Statistics

Matrix Alegbra v. 2.2

This program is an educational tool to help users learn matrix algebra. The program transforms a matrix (up to 6 x 12), and finds the inverse of a matrix (up to 6 x 6). The program can be used in three modes: 1) solve automatically with a detailed explanation; 2) solve with the user specifying the operation and the computer carrying out the arithmetic steps; or 3) solve automatically without explanation.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Not So Simple Arithmetic v. 1.0

This collection of small applications includes Base Changer, Multi-Base Arithmetic, Simultaneous Equation Solver, Hyperbolic Function Table, Prime Factors, and Prime Generator. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

STAT HELPER I v. 2.2 Instructor and Student Versions

Stat Helper I is an interactive program designed to guide the user through the process of statistical problem solving. It differs from many other statistical software packages in that it does not allow the manipulation of raw data. The heart of the software is the Decision Tree, which leads the user through the problem-identification phase. The Decision Tree allows the user to work through "self-correcting" word problems.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Mathematics and Statistics

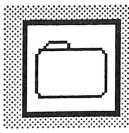
STAT HELPER II v. 1.1
Instructor and Student Versions

Stat Helper II is an interactive program designed to guide the user through the process of statistical problem solving. Unlike other statistics programs, this program does not calculate but guides students in learning how to do ANOVA, simple regression, means, proportions, and hypothesis testing. The sample problems are "self-correcting," and a Decision Tree is used to guide students through the problem. (See STAT HELPER I.)
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Medicine

Development of a Community Health Assessment Profile

This project uses Macintosh Pascal to develop a community health assessment profile program. The program is shared with other community health nurses/professionals through presentations at professional meetings, professional literature, and continuing education workshops. Two workstations are being used. Original software is being developed and will be available. Final users include undergraduate and graduate students.
Current status: In progress.
Contact: Malia Johnson, Nursing, University of Texas, Austin, TX 78712



Miscellaneous

Drexel Plot v. 1.3

Drexel Plot is a graphing application that, among other things, allows the user to enter up to four paired sets of data and place as many as four lines on the same graph. The user can select the range, increments, and axis origin for the graph, and the numbers of decimal places for the numbers on the grid.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

BRS Simulator v. 1.0

BRS Simulator is designed for use as an introduction to BRS. The program instructs the user on the search techniques for this large database and enables the student to practice these techniques easily and cheaply prior to using expensive on-line time.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Drexel Disk v. 2.0

The Drexel Disk uses an interactive map of the Drexel University campus to orient new Macintosh users to the microcomputer-related facilities available.
Current status: Completed and available free by sending a disk and a self-addressed, stamped mailer to the contact person.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Nutrition

MacDiet Student Version v. 1.1

MacDiet is a tool that students of nutrition can use in performing nutritional data manipulation. The user inputs personal data, diet order, meal information, and physical activity level. With this information, reports on RDA Comparison, Dietary Goals, and Activity Level can be produced. Three days of information may be analyzed at a time using the student version. A professional version is available only through Drexel University. Version 1.0 is available now and v. 1.1 will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

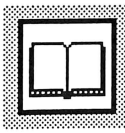
MacDiet Expanded Data Base v. 1.1

The MacDiet Expanded Data Base contains information on 2,400 foods with 24 nutrients. This database can be used in lieu of the database included with the MacDiet application (see MacDiet Student Version). The student version MacDiet database contains information on 1,000 foods with 18 nutrients. Version 1.0 is available now and v. 1.1 will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Pharmacy

Computer-Assisted Clinical Instruction and Performance Assessment in Doctor of Pharmacy Students: A Systematic Approach

Pharmacy students working in a San Antonio mental hospital use a database program running on the Macintosh to keep detailed histories of drugs administered to patients. The database system also provides summary data for research studies and term papers. Software packages used include Helix, Multiplan, and Microsoft Word. Four workstations are involved. Final users are both undergraduate and graduate students.
Current status: In progress.
Contact: Larry Ereshefsky, Pharmacy, University of Texas, Austin, TX 78712



Philosophy

Boole and Frege (for Logic Learning)

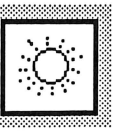
These two programs allow student practice and tutorial use of truth tables and natural deduction systems. While software for such purposes has existed for some time, this suite of programs aims to be easily usable by computer illiterates and to minimize the clerical work associated with proper proof procedures and presentation. Use of the keyboard is required only for input of assumptions and one's own problems; all other work is done using the mouse. For example, the truth-table program draws the table and simply invites input of values. In natural deduction proofs, the student simply clicks on proof lines, clicks on the rule, clicks on DoIt, and gets either a good line or a diagnosis of errors. In general, the system follows the conventions of Lemmon's *Beginning Logic* but may also be used in connection with systems such as Copi's. There are facilities for a user-configurable library of preassigned problems.

There is also a user-configurable help facility of some sophistication, but it is not yet "intelligent." We shall continue to develop and enhance this software, and we are currently exploring an intelligent help facility that can make suggestions to the student in the course of a proof. The programs are written in Modula2, and embedded in them but modularized is a Macintosh interface that could be employed in other, similar applications.

Current status: The truth-table program (Boole) and the natural deduction system (Frege) are complete. Frege offers two modes, one for sentential logic and one for decidable cases of predicate expressions. Send $15 for each program to the address given below.

Contact: David R. Bell, Dept. of Philosophy, Colorado State University, Fort Collins, CO 80523

Physics



MacPhysics Course

During the past quarter, an experimental course on "MacPhysics" was organized. The content of this first course was pretty rough and ready, but is expected to improve in future years. Student display projects included the following:

- Displaying hole and electron densities versus position in a semiconductor p-n junction.

- Displaying Hermite-Gaussian mode patterns in a stable laser beam.

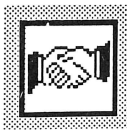
- Simulating the display screen of a multichannel analyzer measuring radioactive elements.

- Showing temperature and fuel concentration versus distance in a methane-air flame.

Students used either Microsoft BASIC or a version of Pascal.
Current status: Completed.
Contact: Anthony E. Siegman, Professor of Engineering, Dept. of Electrical Engineering, Edward L. Ginzton Laboratory, Stanford, CA 94305-4085; (415) 723-0222

Quantum Mechanics v. 1.7

The Quantum Mechanics disk contains four programs that perform different types of quantum mechanical calculations for a restricted class of potentials. Each calculation is carried out by solving Schroedinger's equation for a piecewise constant potential. The method of solution involves matching the wave function and its first derivative at each boundary in the piecewise constant potential.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667



Psychology

Biopsychology Lab Course

Two Macintosh computers aid students in a new undergraduate lab course in biopsychology. Areas of interest include spatial mapping, electrophysiology, auditory processing, and electromyography. Original software is being developed and will be available. Final users are undergraduate and graduate students.
Current status: In progress.
Contact: Timothy Schallert, Psychology, University of Texas, Austin, TX 78712

Observe v2.0—A Package for Observational Research

Observe v2.0 records "stream of behavior" counts, durations, sequences, states, and latencies. A Tandy 100/102 portable computer can also be used as the recording unit.
Current status: Available now.
Contact: Richard Deni, Drawer W, 32 Merritt Drive, Lawrenceville, NJ 08648

Controller

Part of the MacLaboratory (Psychology) series. Software and hardware to control laboratory equipment.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Hemispheric Function—MacLaboratory for Psychology Disk 2 v. 1.0

This software permits tachistoscopic presentation of stimuli to any portion of either visual field under accurate and flexible experimental control. Standard Macintosh features allow for the creation of files for a wide variety and type of visual stimuli. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Neural Modeling in Vision—MacLaboratory for Psychology: Public Domain v. 1.0

This collection includes text, templates, and figures designed to allow interactive student discovery of some features of retinal circuitry. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Psychology

Neuropsychology of CNS—MacLaboratory for Psychology Disk 1 v. 1.0

This interactive tutorial illustrates the anatomical and behavioral relationships among the major cortical and subcortical structures of the central nervous system. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Perceptual & Motor Skills—MacLaboratory for Psychology Disk 1 v. 1.0

Various experimental settings permit the study of motor skill learning and eye-hand coordination using such tasks as mirror tracing and pursuit rotor tracking. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Pitch Discrimination—MacLaboratory for Psychology Disk 3 v. 1.0

This is software for the psychophysical study of pitch. Waveform, frequency, amplitude, and duration can be modified and arranged into various sets for auditory testing. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Polygraph

A simulated GSR that, with appropriate user interaction, can illustrate the following: the orienting response, habituation, classical conditioning, extinction, spontaneous recovery, partial reinforcement, and other concepts from the psychology of learning. Data on GSR latency, amplitude, and duration are saved in tab-delimited text files.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Psychology

Problem Solving—
MacLaboratory for Psychology
Disk 2 v. 1.0

At the level of Introductory Psychology, this application is used to investigate the social interaction of group size with task difficulty. Stimulus files and experimental conditions are readily edited, permitting a number of problem-solving tasks. Data are saved as tab-delimited text files. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Reaction Time

This program is part of the MacLaboratory series to test reaction times.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Survey Data Summary—
MacLaboratory for Psychology
Disk 4 v. 1.0

This software provides frequency tabulations, and means and standard deviations for files created by Survey Questionaires. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Survey Questionnaires—
MacLaboratory for Psychology
Disk 4 v. 1.0

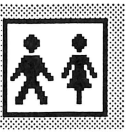
Survey Questionnaires is an application that structures questionnaire files that can be readily edited to facilitate the collection of survey data. Files may be saved for analysis by Survey Data Summary. This program will be released in early 1988.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Psychology

Tone Generator—MacLaboratory for Psychology Disk 3 v. 1.0

This supporting application provides an easily edited system to create an infinite variety of waveforms for use in auditory perception experiments. Waveforms can be saved and used in the application Pitch Discrimination.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Social Science



Third World

This software simulates the economy and politics of a Third World nation during and after the fall of a dictatorship.
Current status: In development.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Writing

Create v. 1.0

Create is a writing program with two major components. The first is a prewriting component designed to stimulate ideas about the direction of a document and aid the writer in narrowing a topic and focusing specifically on what will be the topics. The second component, Recreate, is used after the document is written, for revising and rewriting.
Current status: Completed.
Contact: Dr. Jan Biros, Coordinator, Microcomputer Program, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-2667

Writing

Tools for Writers v. 1.1

Tools for Writers allows students to perform checks and diagnostic tests on their own writing. It shows students' problems with spelling, grammar, and usage. In addition, it helps students with paragraphing, diction, subordination, and the use of the passive voice. It can be used in a variety of ways to help writers develop and refine their writing.
Current status: Completed and available.
Contact: Dr. Eva Thury, College of Humanities and Communications, Drexel University, 32nd & Chestnut Sts., Philadelphia, PA 19104; (215) 895-1711

Writing by Design

Writing by Design is a highly visual brainstorming and planning program that allows writers to generate ideas freely and then organize them into an analysis tree before they start writing a rough draft. Using graphic representation and hypertext, the program is structured to facilitate creativity and the free flow of ideas on the one hand, and to establish logical relationships and clear organization on the other. It deliberately brings the concept of top-down design from computer programming into the writing process. It has been programmed using the Design Open Architecture Development System by Meta Software Corporation, 55 Wheeler St., Cambridge, MA 02138; (617) 576-6920. Design is a powerful graphics program for the design and analysis of complex systems.

The Writing by Design manual gives directions for using the program and also discusses the writing theory behind it: creative brainstorming, root concepts, satellites, and networks of associations, top-down design in writing, sequential organization and levels of generality, problem-solving and decision-making with analysis trees, and more.

Writing by Design has been created by the CIRCLE Programming Group at the University of California, Santa Barbara: Larry Kimmett, coordinator; Dr. Joan P. Mitchell, author; Donna Blakely, programmer; Dr. John Doner, advisor.
Current status: Undergoing testing.
Contact: CIRCLE Programming Group, Phelps 1521, University of California, Santa Barbara, CA 93103; (805) 961-8335

Wheels for the Mind Reader Survey

Dear *Wheels for the Mind* Reader:

We hope that you are enjoying the information about Macintosh use in higher education brought to you each quarter by *Wheels for the Mind.* We are also very interested in your reactions to this publication. To help us ensure your enjoyment of future issues, we would appreciate your cooperation in filling out this survey about the current organization and content of *Wheels for the Mind.* Please write in your answers on the printed tear-out form, and then mail the form to:

Wheels for the Mind
Apple Computer, Inc.
20525 Mariani Avenue, M/S 36L
Cupertino, CA 95014

Be sure to answer all questions, bearing in mind that we are interested in your candid opinions.

PLEASE CHECK ONE BOX FOR EACH ITEM. FEEL FREE TO ADD ANY COMMENTS YOU MIGHT HAVE.

I. Overall Opinion About *Wheels for the Mind* Sections

1. What information is currently VERY useful to you and your organization or institution?

a. Focus Section: Concentrates on a different theme in each issue. Includes overview, case studies, and additional resources that support the theme.

Continue	Discontinue	Change
[ ]	[ ]	[ ]

Comments_____

b. Spotlight Section: Highlights some of the Macintosh activities going on at various schools and universities.

Continue	Discontinue	Change
[ ]	[ ]	[ ]

Comments_____

c. News and Notes Section: Offers information of general interest, including events, resources, Apple news, and information on new Apple products.

Continue	Discontinue	Change
[ ]	[ ]	[ ]

Comments_____

d. Products Section: Highlights new or unusual Macintosh products that are of interest to the academic community.

Continue	Discontinue	Change
[ ]	[ ]	[ ]

Comments_____

e. Project Reports: Includes projects that are being developed at various colleges and universities.

Continue	Discontinue	Change
[ ]	[ ]	[ ]

Comments_____

I. Possible New Sections

What do you think the ultimate *Wheels* should consist of?

	INCLUDE	DON'T INCLUDE	NO OPINION
HyperCard Section	[ ]	[ ]	[ ]
Interviews with faculty, administrators, and students	[ ]	[ ]	[ ]
"How to" articles on applications	[ ]	[ ]	[ ]
Technical information	[ ]	[ ]	[ ]
Question and answer column	[ ]	[ ]	
Surveys on what schools are doing	[ ]	[ ]	[ ]
Creative solutions to universal problems—as developed by various schools and universities	[ ]	[ ]	[ ]
h. Programming tutorials	[ ]	[ ]	[ ]
i. Actual program listings	[ ]	[ ]	[ ]
j. Product comparison charts	[ ]	[ ]	[ ]
k. Special topics, such as multimedia, authoring, and expert systems	[ ]	[ ]	[ ]

Comments_____

III. About Yourself

1. What Macintosh systems do you have access to at home?_____

_____

2. What Macintosh systems do you have access to at work?_____

_____

3. What are your primary applications for Macintosh in your work?_____

_____

4. Which software products do you use most often?_____

_____

IV. Future Dreams

1. **What other recommendations would you make to the planners, designers, and producers of *Wheels*?**

_____

_____

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